REPORT ON THE OPERATIONS OF THE DEPARTMENT OF AGRICULTURE MADRAS PRESIDENCY

FOR THE YEAR

1939–40

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R.O.C. No. D. 68-Pdl./40.

OFFICE OF THE DIRECTOR OF AGRICULTURE,
MADRAS, *dated the* 31*st October* 1940.

From

A. R. C. WESTLAKE, ESQ., I.C.S.,
Director of Agriculture,
Madras,

To

THE SECRETARY TO GOVERNMENT,
DEVELOPMENT DEPARTMENT,
Fort St. George, Madras.

SIR,

[Administration Report—Agricultural Department—1939-40.]

I have the honour to submit the following report on the operations of the department for the year ending 30th June 1940.

I.—ADMINISTRATION.

Sri P. H. Rama Reddi continued to be in charge of the department till 10th June 1940. He proceeded on leave for six months from 11th June 1940 and on that date I assumed charge of the department.

During the year Sri P. H. Rama Reddi attended the meetings of the Irrigation Development Board at Madras, the meetings of the Indian Central Cotton Committee at Bombay and Coimbatore and the meeting of the Advisory Board of the Imperial Council of Agricultural Research at Delhi.

For purposes of district administration the Presidency is divided into four circles each in charge of a Deputy Director of Agriculture. Under each Deputy Director of Agriculture there are three or four Assistant Directors of Agriculture who are in direct charge of district

work with an Agricultural Demonstrator for each taluk. The distribution of Circle and Assistant Directors' charges is as shown below :—

Circle officer.	Headquarters of Assistant Director of Agriculture.	Assistant Director of Agriculture's charges.	Number of taluks.	
I Circle with headquarters at Cocanada.	(1) Vizagapatam ..	Vizagapatam	19	59
	(2) Rajahmundry.	East Godavari .. .. West Godavari	20	
	(3) Guntur ..	Kistna .. .. Guntur .. .. Kurnool (two taluks of Cumbum and Markapur).	20	
II Circle with headquarters at Cuddapah.	(4) Nellore ..	Nellore .. .. Chittoor (three taluks of Puttur, Kalahasti and Tiruttani).	16	62
	(5) Cuddapah ..	Cuddapah .. .. Kurnool (seven taluks) ..	15	
	(6) Bellary ..	Bellary .. .. Anantapur	18	
	(7) St. Thomas' Mount.	Chingleput .. .. Chittoor (six taluks) .. Madras	13	
III Circle with headquarters at Trichinopoly.	(8) Cuddalore ..	Tanjore .. .. South Arcot	14	51
	(9) Madura ..	Trichinopoly .. .. Madura	15	
	(10) Tinnevelly ..	Ramnad .. .. Tinnevelly	17	
	(11) Pattukkottai..	Five taluks	5	
IV Circle with headquarters at Coimbatore.	(12) Tiruppattur ..	Salem .. .. .. North Arcot	21	49
	(13) Coimbatore ..	Coimbatore .. .. Nilgiris	13	
	(14) Tellicherry ..	Malabar .. .. South Kanara	15	

There are Agricultural Demonstrators in 203 out of these 221 taluks. Men to work in the remaining 18 taluks are being trained or recruited.

There were no important changes in the administration. Minor changes will be found in Appendix I.

II.—(A) AGRICULTURAL EDUCATION.

2. *The Agricultural College, Coimbatore—Admissions.*—As reported in the last year's report, 50 students were admitted to Class I during 1939–40.

During the year 1940–41, 194 applications were received for admission as against 232 in the previous year and 138 candidates appeared for interview before the Selection Committee at Rajahmundry, Madras and Coimbatore, of whom 47 were selected and 9 were placed in the waiting list. Only 36 of the selected candidates joined the College in first week of July 1940 and six seats were

filled from the waiting list. Two students from Hyderabad State were also admitted of whom one was a failed student of last year who was re-admitted. The final strength of Class I stood at 44.

The following tables show the number of students admitted from each community and under different linguistic basis :—

TABLE I.

Brahmans	20
Non-Brahmans	9
Muhammadans	4
Backward	10
Scheduled	1
	44

TABLE II.

Telugu	21
Tamil	14
Malayalam	3
Kanarese	4
Urdu	2
	44

Scholarships.—Five scholarships were awarded to students in the I year class of 1939–40—two to Muhammadans and three to students belonging to backward communities. Two scholarships that were awarded to two students belonging to backward communities during the year 1938 having fallen vacant were re-allotted—one to a student of Class II during his second year course and the other to a student of Class III.

Examinations.—The results of the B.Sc.Ag. examinations in 1940 are as follows :—

	Number appeared.	Number passed.
First examination	52	42
Second ,,	41	31
Third ,,	38	34

Nine candidates referred from the second examination in 1939 appeared, and four of them passed while the remaining five failed. Six candidates referred from the final examination in 1939 appeared and five of them passed, bringing the total qualifying for the degree to 39.

University lectures.—The following lectures were delivered at the College under the auspices of the Madras University :—

(1) "Rural Youth and Organization, Rural Education, the University and Rural Life" by Dr. De Valois, Principal, A.A.M. Agricultural Institute, Katpadi;

(2) "Fundamental Ideals in Rural Development" by Sri K. Unnikrishna Menon;

(3) The Travancore-Curzon lecture on "Economic Factors in Agricultural Development" by Sri K. C. Ramakrishnan.

Tours.—Besides the week-end short trips to adjoining villages to study agricultural practices students of Class III and Class II were, as usual, taken on long tours during October 1939 and January 1940, respectively to visit areas and institutions of agricultural interest.

Short courses in practical agriculture.—The following short courses were conducted during the year at the Agricultural College, Coimbatore :—

Course.	Number of students admitted.
1 Farm management	10
2 Horticulture and vegetable gardening	2
3 Insect pests and diseases	2
4 Dairying	1
5 Care of animals	3
6 Bee-keeping	3
7 Jaggery-making	4
8 Farm implements and machinery	4
9 Malt-making	1

The students attending "Farm Management" course attended the special courses also.

College day and conference.—The 28th College Day and Conference was held from 13th to 16th July 1939 under the presidency of the Hon'ble Sri V. V. Giri, Minister for Industries and Labour. Medals and prizes were presented to the successful students by the President. An agricultural exhibition was also conducted during the conference which attracted a number of visitors.

Dairy.—Particulars relating to the College Dairy will be found in Appendix II.

(B) OTHER INSTITUTIONS.

3. *Short course at Nandyal.*—The short course in Agriculture was continued at the Agricultural Research Station, Nandyal. Forty-one applications were received; twenty were admitted and only 12 completed the course. In addition to the above, 10 messengers and maistris were trained at the station.

Courses in fruit culture.—Fourteen students and one post-graduate student underwent training in Fruit Culture and nursery practices at the Fruit Research Station, Kodur. In addition to these, 13 upper subordinates and 4 maistris were trained at the station.

Farm Labourers' Schools.—The three schools at Anakapalle, Palur and Coimbatore continued to provide elementary education to the children of labourers employed on farms and (on a half-time basis) to children working on the farms. At Anakapalle, there were on the rolls 28 boys on the average as against 24 of last year, and 48 adult labourers in night school as against 34 of previous year. At Palur, the average strength of the school was 45 against 44 of last year. At Coimbatore, there were 10 boys with wages and 18 without wages, which is the same as in previous year.

Lectures for rural workers.—Under the auspices of the University of Madras lectures to rural workers were given by officers of this department.

III.—Season.

4. The south-west monsoon of 1939 which started late in June was not vigorous in July or in August. The Arabian sea current was feeble and the rainfall in these months was generally in large defect. Although the rainfall in September was generally fair, it was less than the normal in all districts except Guntur, Cuddapah, Chingleput and Salem. The area sown during this monsoon period was generally above the average except in the Circars and the Carnatic.

The north-east monsoon set in over the Bay of Bengal on the 28th October; there was however widespread rainfall between the 19th and 23rd in the north Madras coast. The precipitation in the Circars in October was nearly half of the total average fall in this monsoon period while it was above normal elsewhere except in Anantapur, Chingleput and Tinnevelly. The disturbed conditions in the Bay on the 7th and 15th of November associated with the cyclonic storm on the latter day resulted in heavy rainfall in this month throughout the province except in Vizagapatam. Trichinopoly, Negapatam, Cuddalore, Ootacamund and Kodaikanal recorded the heaviest fall. Many tanks in Ramnad and Nellore breached. Parts of Trichinopoly and Tanjore districts suffered damage to standing crops through submersion caused by heavy rains and breaches. December to February were rainless. The sowings of crops favoured by this monsoon were satisfactory and above normal except in the case of wet lands.

There were unusual rains in March 1940 in the Circars. The rainfall in March–April (summer rains) was generally normal and favourable.

Unlike in 1939, there was a temporary advance of the south-west monsoon in 1940 which broke in vigorously in the third week of May. Rainfall in that month was heavy in the Circars and the Deccan and moderate and widespread elsewhere. Showers accompanied by violent dust storms on the 28th May resulted in a running train being capsized at Tindivanam; some breaches in the Madras and Southern Mahratta Railway line along the coast were also reported. The activity of the monsoon was maintained in June except for a lull in the first fortnight. Rainfall in this month was general over the Presidency and above the average except on the Malabar coast and locally in the Ceded districts and Circars. Gingelly in Vizagapatam suffered somewhat from heaviness in moisture. Except for this, the rainfall in May-June was good and the prospects are generally bright.

The effect of the season on the crops at the various Agricultural Research stations.—The uneven distribution of both the south-west and north-east monsoons—the former scanty and late and the latter heavy and concentrated in October–November affected the crops generally in all stations except at Nandyal, the coconut stations on the West Coast, Pattambi and Nanjanad. Dry crops at Nandyal, coconuts and paddy on the West Coast and potato at Nanjanad yielded well. The season was unpropitious for paddy at Anakapalle, Samalkot, Maruteru, Palur (short duration variety), Ambasamudram (second-crop), and the Paddy Breeding station at Coimbatore, either due to want of rain or heavy rains. The violent cyclonic gales in March 1940 spelt havoc to standing crops of mature sugarcane and caused irretrievable damage to plantations at Anakapalle. Pyru jonna at Guntur had borer attack and red mite owing to heavy rains in October. Good yields of cotton in mixture with korra and late cotton were obtained at Hagari, the yield of the mixture being very good. At Palur, considerable damage to the late sown groundnut was caused by " Surul " poochi which appeared as a serious pest. Pulses at Koilpatti failed completely due to insufficient rainfall while the incidence of mist in February caused some bud and boll shedding of cotton affecting the yield. The weakening of the monsoon in August–September affected all the dry crops at Taliparamba and reduced their yields to a large extent. The main potato crop in portions at Nanjanad sown in April 1940 was defoliated in June due to high winds and rain which also caused considerable shedding of immature and ripe fruits at the Fruit stations in the Nilgiris. Except cholam on the Cotton Breeding station, the other crops here and on the Central Farm were adversely affected. Despite drawbacks of the season, the yield of paddy at Aduturai was quite good, the second-crop giving the highest record yield. Pattukkottai on the other hand did not fare well, dry and garden crops being affected by long droughts and heavy rains. The raising of inter-crops in the programmed area at Kodur had to be given up owing to the failure of the south-west monsoon and the prolonged drought till October. At Gudiyattam paddy fared well but sugarcane, the main crop of the station, was detrimentally

affected by heavy showers in October. The uneven distribution of the south-west monsoon rains with heavy precipitation late in September at Siruguppa adversely affected the early cholam crop in earhead and led to the setting of immature bolls in cotton; the hingari (late) cotton crop was however good.

IV.—RESEARCH.

5. Agricultural research in the Madras Presidency is carried on partly by research officers such as the Government Agricultural Chemist or a Crop Specialist and partly by the Superintendent of the Central Farm and by District Officers with guidance from the research officers. Research work is carried out at the Central Farm at Coimbatore or at the various Research stations and for some purposes land is specially leased. Local needs dictate to a large extent the lines of research pursued, that is to say that in plant breeding the specialist engaged will endeavour to evolve types of plant suitable for local seasons and resistant to local pests. Details of such work will be found below in the sections of the report dealing with various crops. Inevitably many of our problems are similar to or related to the problems of other parts of India and it is desirable in the interest of India as a whole that research into such problems should be directed as to obtain the maximum result. It may for example be advantageous that the same problem should be studied in a number of places on identical lines or that on the contrary it should be divided into component parts each part of the problem being studied in the place where the greatest facilities exist.

Such direction is given to research in the Provinces by the Imperial Council of Agricultural Research and in respect of cotton by the Indian Central Cotton Committee, who either suggest schemes of research or accept those submitted by Provincial or State Governments as likely to be of value to the country as a whole. For the carrying out of such schemes lands, materials, implements, men and money are necessary and these are supplied in varying proportions by the local Government and by the Council or Committee concerned. It will be convenient to give a list of such schemes in this place, though all are not strictly research schemes, and they are shown in the following table.

The schemes financed with the aid of grants made by the Indian Central Cotton Committee and the Imperial Council of Agricultural Research during the year 1939–40.

Name of the scheme. (1)	Expenditure during 1939–40. (2)	Place of work. (3)	Controlling officer. (4)	Object for which the scheme is started. (5)
		Indian Central Cotton Committee.		
	RS.			
1 Pempheres and Physiological scheme.	7,723	Coimbatore and Srivilliputtur.	Cotton Specialist	Control of cotton stem weevil and the evolution of a strain in karunganni cotton resistant to the harmful effect of February rains.
2 Nadam Cotton Breeding Scheme.	2,027	Perundurai in Coimbatore district.	Do.	To secure one or two suitable annual types of cotton, capable of replacing Nadam, a perennial variety in the red soils of Salem and Coimbatore districts, which serves as a breeding ground for pests like the stem weevil and pink boll-worm during the close period of Cambodia prescribed under the Madras Pest Act.
3 Scheme for the improvement of Mungari cotton.	6,153	Adoni in Bellary district ..	Worked by a Gazetted Assistant under the control of the Cotton Specialist.	Evolution of strains suitable to the red soils and combining the quality of the Westerns with the yield of Mungari, to replace the inferior Mungari, the existence of which affords opportunities for mixing, with the result that the better cottons of the tract fail to get their proper value.
4 Scheme for the maintenance of nucleus of pure cotton seed.	513	Koilpatti, Coimbatore and Hagari.	Cotton Specialist	Maintenance of nucleus of pure seed of improved varieties of cotton, Co. 2, and H. 1. K. 1.
5 Scheme for the investigation of the possibilities of control of cotton stem weevil.	1,690	Coimbatore	Worked by Parasitologist under the control of the Government Entomologist.	Survey of the distribution of stem weevil and exploring the possibility of checking its spread by biological methods.
6 Scheme for the improvement of Cocanadas cotton.	343	Guntur and Narasaraopet.	Worked by a Gazetted Assistant under the control of the Cotton Specialist.	Improving the acre yield of Cocanadas and ginning percentage keeping at the same time the valued lint colour.
7 Co. 2 Seed Multiplication Scheme.	1,077	Tiruppur	Deputy Director of Agriculture, IV Circle.	Production of Co. 2 seed in Coimbatore district through the agency of the Tiruppur Co-operative Sale Society.

Imperial Council of Agricultural Research.

1 Scheme for investigation of Sunnhemp.	498	Samalkota	Assistant Director of Agriculture, Rajahmundry.	Improving the quality of fibre by modification in cultivation, harvesting, retting, washing, drying and studying the effect of seed-rate, variation in time of sowing and manuring treatments.
2 Dry Farming Scheme ..	15,060	Hagari	Superintendent, Dry Farming station, Hagari, under the control of the Deputy Director, II Circle.	Improvement of crop production in areas of precarious and inadequate rainfall where irrigation is impracticable.
3 Fruit Research Scheme ..	14,732	Kodur	Superintendent under the control of the Deputy Director, II Circle.	Horticultural improvements of fruits such as mangoes, citrus and Sapodilla with special reference to the classification of local types, and problems of propagation, tillage, manuring and irrigation.
4 Scheme of marketing ..	21,488	Madras	Assistant Marketing officers under the control of the Provincial Marketing Officer.	Survey of crops.
5 Scheme of research on groundnuts.	8,946	Tindivanam	Superintendent under the control of the Oil Seeds Specialist.	Isolation of pure lines for high yield, high oil content, high shelling percentage, and low free fatty acid content, production of varieties with short, intermediate and long durations. evolution of drought resistant varieties, study of inheritance of economic characters and study of manurial and water requirements.
6 Scheme of research on coconuts.	8,257	Kasaragod	Do.	Investigation of problems in connexion with yield of nut, yield of copra and yield of oil and the manufacture of coirs.
7 Scheme of research on sugarcane.	23,472	Anakapalli and Gudiyattam.	Superintendent, Agricultural Research Station, Anakapalle, under the control of the Deputy Director, I Circle.	Varietal, cultural and manurial experiments, methods of reducing the cost of cane production and improvements in the manufacture of jaggery.
8 Animal nutrition scheme.	8,982	Coimbatore	Government Agricultural Chemist.	Study of the mineral metabolism of cattle, effect of manuring on the composition of food stuffs and fodders and their nutritive value and study of the nutrition of milch cattle and pasture investigations.
9 Insects pests scheme ..	5,265	Gudiyattam	Government Entomologist ..	Research on caterpillar borers of sugarcane.

An account of the work done both under these schemes and otherwise will be found in the sections which follow.

A.—Chemistry.

6. *Analytical and Advisory.*—As in previous years the analytical and advisory branch of the section was active. During the year under report this branch dealt with 1,677 samples of soils, manures, water, foods, fodders and other agricultural produce. Of this total, the number of samples sent by members of the Agricultural department numbered 829, and those sent by other Government departments 210, while 17 samples were analysed for ryots and other private parties and 21 for members of the United Planters' Association of South India.

A notable feature of the work of this branch was the analysis of samples of soil received from the Public Works Department as to their suitability for bund formation. Sixty samples were sent by the Public Works Department in connexion with the Pundi Reservoir Scheme. The samples were analysed and the soils from the fields in Pundi and Rangapuram villages were selected as suitable for the purpose of forming the earthen bund for the reservoir.

Reclamation of alkaline soils.—The work on the reclamation of alkaline soils in the Kulittalai taluk of the Trichinopoly district under the Kattalai High Level Channel which was started in 1937, was brought to a conclusion by the harvest of the paddy crop (samba) in January 1940 and the completion of the analysis of the soils and sub-soils taken after the harvest of the paddy crop.

The area was reported to be highly alkaline and capable of growing no crops. A preliminary inspection in 1936 showed that this was mainly due to the lack of drainage from the area which lay between the new High Level Channel and the old South Bank channel. Work was started in October 1937 by treating an experimental block of land near the village of Mettumarudur with gypsum and sulphur. Since then two crops of Dhaincha have been grown and ploughed in, and two crops of paddy harvested. The results of the second crop of paddy are very satisfactory, being about 2,000–3,000 lb. per acre in the treated plots while the control plot gave practically no crop at all. The chemical analysis of the soils before and after treatment show a marked improvement in their reaction (pH) from one at which no crop growth was possible to one at which a good crop of paddy could be raised. Of the treatments, gypsum at 10 tons and 5 tons per acre were found to be equally good as those with sulphur at 1 and 2 tons per acre. Sulphur is now practically unobtainable and that too at a price beyond the range of practical application. Gypsum is locally available in abundance and at about Rs. 10 per acre the higher application of 10 tons per acre means a cost of Rs. 100 per acre to bring land under crop on which nothing would grow before—not even grass, not to speak of crops like paddy. It is proposed to repeat these experiments on similar soils at three other centres in the same area next year.

Studies on the black soils of Madras—Deccan—(a) Soil and rock.—The black soils of the Ceded districts have already been shown to be unique among the soils of this Presidency and can be classed along with the " Chernozems " (black earth), a soil type of world-wide distribution extending from Siberia to the Volga basin into Rumania and Hungary, and again in Sudan, California and Peninsular India. The previous work of the chemical section has shown that the black soils of Madras-Deccan are distinct from the red soils of the same area in their chemical and physical properties, the black soils being distinguished from the red by their being usually heavy clays, often with a layer of salt concentration at lower depths, and a chemical composition characterized by a high silica; sesquioxide ratio. Apart from their peculiar properties in relation to the application of irrigation which was investigated and reported on in the Report on the Soil Survey of the Tungabhadra Project in 1937, the problem of the origin of these soils is still under investigation. The work during the year was mainly directed along the lines of finding a correlation between rock and soil. Twelve rock samples from areas in the Bellary district, covered by black and red soils were analysed for their chemical composition. The results indicated that in general, the rocks of the granitic complex containing Hornblende, gave high values for calcium, magnesium and sodium, all of which are present in the black soils formed from them, while the rocks of the granitic complex consisting of micaceous granites and white granites had a low content of lime, magnesia and sodium and usually gave rise to red soils. No definite conclusion can however be drawn from the present studies which are being pursued further.

(*b*) *Effect of irrigation on black soils.*—The effect of irrigation on the movement of salts in the black soils was investigated at the Agricultural Research Station, Siruguppa, on a field which received light irrigation at varying depths and distribution. These experiments are of fundamental importance in the investigations of schemes for the irrigation of black soils such as the Tungabhadra project. The experiments are not yet complete.

The effect of manuring of seed-bed on the performance of paddy in the transplant field.—It is a matter of common experience in the main paddy-growing areas, especially in the Telugu area that the seed-bed for paddy is always on the best land available and is heavily manured for raising the seedlings. No evidence has been forthcoming till now for the rationale of this practice; in fact the usefulness of the practice has been questioned. Experiments on the Agricultural Research stations till now have been inconclusive and hence an experiment was started on the Central Farm, Coimbatore, in 1938–39 and continued during the year under report (1939–40) with the seed-bed treated with heavy, normal and no manuring from which the seedlings were transplanted into transplant fields with no manure, half-manured and normally manured. The experiments are not yet complete.

Study of the disease "Vayupotlu" among cattle in the Kurnool district.—The disease known as Vayupotlu or Rheumatic arthritis is present in an endemic form among cattle in the Kurnool district. The work done in previous years has shown that it is associated with a deficiency in the phosphoric acid content of natural pastures and the presence of fluorine in the well waters and is thus connected with conditions connected with the nutrition of cattle of the affected areas. A study of the blood of animals affected with the disease in the area also showed a deficiency of phosphoric acid in the blood. The study was extended during the year, by a field survey of the taluks of the Kurnool district where the disease was endemic, to determine the extent of the incidence of the disease and also of the analysis of waters of wells at which cattle are watered. It was seen that the disease was of widespread occurrence in the taluks of Kurnool, Atmakur, Nandikotkur, Koilkuntla and Allagadda of the Kurnool district and that the water of wells in the affected areas had a fluorine content of 1·0 part per million and above and that areas in the Anantapur district and Cuddapah were also similarly affected by the disease and the waters of wells had an appreciable content of fluorine.

Laboratory studies on the methods of removal of fluorine from natural waters showed that the addition of lime, removed almost all the fluorine from water as a precipitate which settled down on standing in a short time. Work will be extended next year on the application of measures to feed phosphate supplements and treatment of wells to remove the fluorine which is one of the causes of the disease.

The malting of cholam.—The work done in the previous years for the making of a malted food from indigenous cereals was continued. Malt foods made by blending cholam malt with paddy malt were successfully prepared. Malt foods were tested in Government, private and Mission hospitals for their suitability for hospital patients, invalids and infants at 27 institutions. The reports received after trial on a large number of cases were favourable, cholam malt was particularly found suitable and beneficial in cases of stomach disorders and with infants and invalids. The trial of varieties of cholam were extended to a number of varieties not till now tested. The varieties tried were those growing in the Ceded districts and found suitable for that tract. Practically all the well-known varieties of cholam have now been found suitable for malting. The malting of cholam was demonstrated in the villages of Chittoor district and as a result, the industry has been taken up as a cottage industry at a number of centres by the Rural Reconstruction Association of that district.

B.—Botany.

7. As Senior Crop Specialist the Millets Specialist is the Geniticist of the College and Research Institute and is in charge of General Botany, Systematic Botany and the Herbarium.

Seed testing.—One hundred and seventy-five samples of seeds were tested for viability.

The Herbarium.—One hundred and eighty specimens were collected from the districts of North and South Arcot and South Kanara. Seven hundred and seventy-five specimens were poisoned and mounted. One thousand and five specimens were identified for various departments and institutions, 485 of these were grasses identified for the Chemist for the study of the mineral contents of South Indian grasses. Nineteen specimens were loaned and 20 spared. Sixty-nine specimens were prepared on request.

Whereas other sections are specializing in certain crops, the Herbarium is the only clearing house for general botanical information. Two hundred and sixty-nine enquiries pertaining to general and economic botany were dealt with, covering a wide range of subjects and a wide circle of enquiries. Notes on medicinal plants, and wild edible fruits were prepared.

Fodder grasses.—Fifteen representative fodder grasses are being grown in 2½ cent plots. Thirty-two pounds of seed were given out for trial, mostly for the use of the Special Grazing Officer.

The grass flora of the North and South Arcot districts was surveyed and a note published.

The Botanic Gardens at Ootacamund and the Sim's Park at Coonoor were maintained by the department as usual. At Ootacamund several improvements were made with an eye to the convenience of those who use the park and various places which might prove dangerous to children were protected by railings. The contents of the nurseries and of the glass houses were thoroughly overhauled. Additions to the garden collections included orchids from Sikkim, bulbous plants such as *Amaryllis*, *Eurycles* and *Kæmpferia*, lilies of various varieties from Darjeeling. One thousand one hundred and eleven trees and shrubs, 6,796 seedlings, 293 cuttings, 50 bulbs and bulbous plants, 33 lb. of tree-seeds and 60 packets of tree-seeds were sold. Botanical specimens were also supplied free to three colleges and also to individuals for class work and examination. Two hundred and thirty pounds of *Ipomœa purga* (Jalap) were planted and the growth was satisfactory. Seedlings of Pyrethrum were planted in different parts of the garden and are thriving well. Five hundred and fifty seedlings raised from seed sent from Yugoslavia have been sent to the Nanjanad Agricultural Research Station for trial. Attempts to grow *Lobelia inflata* and *Barosma betulina* have failed. Numerous scattered pieces of land in Ootacamund designated as Public Parks were kept in order. The Secretariat Garden at Stonehouse Hill has been transferred to the Park Sergeant for upkeep.

At Coonoor various minor improvements were made including new hedges of *Spiraca peruviana* and *Abella*. Cannas do particularly well here and a new bed 56 yards long was planted with different varieties. In the nursery two new terraces were made and

planted with 200 standard rose cuttings. The growth of the Tung oil trees (*Aleurites Fordii*) seems to have slowed up. None of the trees flowered during the year. The biggest tree is 11½ feet high and 6½ inches in girth at 4 feet from the ground.

Six hundred and eighty-nine flower plants and shrubs, 21 standard roses, 37 packets of flower seeds and over 5 lb. of tree-seeds were sold. Twenty pounds of tree-seeds were transferred to Ootacamund for sale.

C.—Crops.

Cereals.

(1) *Paddy.*

8. The main lines of work on the improvement of the rice crop undertaken by the Paddy Specialist at the different rice research stations under his control comprised the following :—

(*a*) Isolation of high-yielding strains from the local varieties;
(*b*) Evolution of strains by hybridization;
(*c*) Study of mutations artificially induced by pre-treatment of seed with X-ray, heat and cold and chemicals;
(*d*) Introduction of suitable varieties from other parts in and outside India; and
(*e*) Improvement of cultural and manurial practices.

Progress of work under these items during the year is briefly reviewed below.

Improvement of local varieties.—Work on three local varieties came to a successful termination by the release of Co. 13, *Arupatham Kodai* of the Periyar area, Mtu. 14, *Bontha Atragada* of West Godavari and Ptb. 12, *Chitteni* of South Malabar, yielding 19, 16 and 12 per cent respectively over the unselected ryots' seed. Yield trials of promising selections in *Vadan samba*, *Vellaikar* and *Sirumani* of Chingleput district and *Kayama* of South Kanara were conducted for the first time in the respective areas for which selections were made. At Coimbatore, the work on *Bangarutheegalu*, a fine variety of repute cultivated in Kurnool, was added to the existing work in progress on the three *Sannavadlu* varieties of Chittoor, *Rangoon samba* of Erode and *Manavari* of Salem. At Pattambi, 1,650 pure lines isolated in six varieties of both first and second crop were under study; while at Maruteru, work on *Pedda Atragada*, *Kusuma* of Kistna and *Prayaga* of Godavari was commenced. For want of a suitable area at this research station work on the rainfed paddy of Godavari was taken up on the Mallavaram village of Kovvur taluk in the land, generously offered by Sri Ganga Razu.

Hybridization.—The hybrid culture 10905 isolated from a cross between Co. 3 and Burma variety, has established its merit both in yield and quality of grain and straw. The hybrid cultures 10998 and 11348 isolated from a cross between G.E.B. 24 and *Korangu*

samba for resistance to blast disease proved their superiority in the districts of Cuddapah and Nellore where there was a severe outbreak of this disease. Two hybrid cultures D.Ws. 10 and 41 named as *Badava Kusuma* isolated at Maruteru acquitted themselves well in the trial in the low-lying areas of Narasapur taluk. All the above hybrid cultures possessing the desirable characters are awaiting release as strains.

Economic mutant from X-ray.—A search for materials of economic value from progenies X-rayed G.E.B. 24 resulted in the isolation of two groups of mutants. One group was short-growing with profuse tillering and the performance of these, for the first time, in the districts of Bellary, Salem and Madura, is very encouraging. The other group of tall and late selections will undergo yield tests.

Improvement by introduction.—*Khasipichodi*, a variety obtained from Hyderabad, continues to be popular as a short second crop (January–April) in the Godavari district. It is also reported to be gaining ground in Chingleput district. The renowned *Patnai* varieties 672 and 673 have yielded 28 and 23 per cent respectively higher than *Rangoon samba* at Erode in the first-crop season (June–October). A few short duration types from China which are likely to fit in with the *Kuruvai* or *Kar* season of south are being acclimatized in Palur and Ambasamudram.

Agronomic studies—(*a*) *Cultural practice.*—Experiments were conducted on spacing and number of plants per hole. They are not yet completed. At Pattambi, an experiment on transplanting versus broadcasting was concluded with the finding that broadcasting with the first heavy pre-monsoon showers in April yielded higher than transplanting after the break of the monsoon in June, while broadcasting with the high monsoon rain yields less than transplanting. Thus on the West Coast, season plays an important part in determining the choice of the method to be adopted.

(*b*) *Manurial trials.*—At Coimbatore, experiments on the choice of manure, as between castor cake, groundnut cake and sulphate of ammonia, and as between different green leaves daincha, wild indigo and *sesbania speciosa*, have shown that it does not matter as to which is applied as long as they are applied on equal Nitrogen basis. The choice mainly depends on the cost of the manure and its easy availability. In another experiment superphosphate applied at planting, on a basal dressing of green leaves, has recorded higher yields than that applied at a later date. At Pattambi, experiments have conclusively proved that a basal dressing of cakes to supply 30 lb. Nitrogen or green leaves at 4,000 lb. per acre with a top-dressing of 15 lb. N. as ammonium sulphate a month before flowering contributes to an increase in the outturn from 25 to 50 per cent over no-manure plots. However, at the current prices of cakes and ammonium sulphate, the application of green leaves alone is economical. Experiments on the merits of

composts as compared with other organic manures, are in progress. A study of the effect of manures on the thickness of bran layer indicates that the thickness increases to a certain extent with the increase in the dosage of the manure applied.

(*c*) Results of the irrigation experiment at Coimbatore indicate that a normal supply of 2 inches of standing water is necessary up to a month after planting and thereafter application of 4 inches of water at intervals of 12 days is sufficient to raise a good crop in Coimbatore.

Besides the above items of research work, the maintenance of the purity of all the strains and their multiplication formed an important item of work. A total quantity of 167,934 lb. of seed paddy was issued to Circle Officers for distribution.

(2) *Millets.*

9. (i) *Cholam or Jonna (Sorghum).*—One thousand one hundred and four separate lots of seed were handled.

Yield trials—Periamanjal cholam.—Seven strains were compared with the local seed. All of them gave significantly higher yield of grain than the local seed.

Talaivirichan cholam.—Seven strains were compared with the local seed. All of them gave significantly higher yield of grain than the local seed. After another year's trial the pick of these will be given out for trial. Owing to water scarcity in the wells only a limited summer crop could be grown this year also.

Crosses for yield.—From the first generation seeds of last year, the second generation of the crosses and back-crosses between Periamanjal and the big headed and big grained African cholams, was raised and from this, selfed seed from 14 selections with Periamanjal affinities was carried forward for further selection.

Fodder improvement.—The local *Periamanjal cholam* is pithy stalked. With a view to improve its fodder quality, it was crossed with A.S. 3355, the good fodder cholam strain of the station, which is juicy, with a heavy tonnage of green fodder. A.S. 3355 has, however, the disability of long duration and less seed, from which A.S. 29 does not suffer. This cross has been made with a view to evolve a strain combining the good qualities of both. Out of 16 selections of Periamanjal with juicy stalk, obtained from the cross with the Bellary Tella Jonna, the five best have been carried forward for yield tests with the Periamanjal cholam strain A.S. 29. *Talaivirichan cholam* is of poor fodder value. A juicy stalked Talaivirichan isolated from a cross with the Bellary Tella Jonna was crossed again with the Talaivirichan strain A.S. 1093 to tone up yield and from this cross three hybrids have been taken for raising the second generation.

Resistance to Striga, the flowering root parasite.—Ten selections consisting of Periamanjal (A.S. 29), Bonganhilo (African), Bilichigan, 4 hybrids from crosses between Periamanjal X Bonganhilo, and Periamanjal X Bilichigan and 3 back-crosses from the above were sown in the Striga infected plot. From these, eight selections with Periamanjal affinities and resistant to Striga were carried forward. These will be tested for purity and Striga resistance, and the promising ones will be compared for yield with the standard, A.S. 29.

Cholam malt.—Seeds of six fresh varieties were supplied to the Agricultural Chemist for testing. This brings the total number of varieties grown and supplied for this purpose since 1934 to 57. Of these 19 are from Madras, 15 from other provinces, 17 from Africa and 6 from America.

District trials.—In Periamanjal cholam strain No. A.S. 29 has done well in the taluks of Pollachi and Tiruppattur. Talaivirichan cholam strain A.S. 1093 has proved its superiority in the Coimbatore taluk. In the Chittoor-Tiruppattur area the strains of this variety gave conflicting results and local seed has been gathered for work at headquarters, as there is no centre for seed selection in the Tiruppattur area. In red cholam A.S. 389 has yielded better than the local seed in Musiri, Kulittalai and Tiruchengode taluks. In yellow cholam A.S. 809 was found to be the best for the Coimbatore taluk. Among white grained strains A.S. 1543 was found suitable for the Coimbatore taluk, A.S. 732 for Bhavani, A.S. 1575 for Pollachi and A.S. 2095 for Palni. A.S. 2095 is rapidly spreading. A landlord of Peelamedu (near Coimbatore), purchased 1,000 lb. of seed of this strain in 1938. He preserved seed from the crop raised and grew a 50 acre block under this strain in the Vedapatti village in 1940. Another ryot took over 1,000 lb. in 1939. Less opulent ryots obviously draw their small seed requirements from these sources and the natural spread goes on imperceptibly.

At Hagari a Bombay Sorghum M. 47-3 has proved to be much better than the local type of cholam. At this station attempts are being made to evolve drought evading short duration economic white-grain types by crosses between two of the American sorghums and the local type.

(ii) *Cumbu.*—Three hundred and forty-one lots of seeds were sown.

Yield trials.—Last year the trials with rainfed strains were affected by severe drought. This year the trials were repeated with the same 5 strains and the standard P.T. 248, the local Kattu cumbu strain. In grain yield strain P.T. 367 gave a higher yield of 11 per cent over the standard while in straw yield P.T. 17 and P.T. 720 excelled the standard. Owing to water scarcity in the wells only a limited irrigated crop could be grown. The variety of cumbu known as the *Australian hybrid* in parts of North Arcot was tried for the first time at the station in small plots both as an irrigated and rain-fed crop. It had long heads, intermediate in

length between the "Whip" cumbu and the Jamnagar Giant. The emergence of the earhead was rather poor and the grain setting at the basal portion of the head was defective. It looked promising in both seasons and further trials will show how constant it can be. *The varietal survey* which was commenced last year was completed. Three taluks in Coimbatore and seven in Salem were visited. Sixty-two samples of seed of local varieties were collected for growing and selection.

Seed multiplication.—The chief source of seed for multiplication, viz., the Central Farm could not cope with the demand this year, due to water scarcity. To meet the great demand for the seed of P.T. 700, arrangements were made with the Hon'ble Sri V. C. Vellingiri Gounder to multiply the seed in his fields. The crop was rogued by the departmental staff and the required seed was purchased for distribution.

District trials.—Trials were conducted with *cumbu* strains in the districts of Coimbatore, Salem, Trichinopoly, North Arcot and Chittoor. Strain P.T. 700 met with success in all the five districts and there is a great demand for its seed. P.T. 499 found favour in the Salem and Trichinopoly districts and P.T. 2229 in the North Arcot district.

(iii) *Ragi.*—One thousand and seventy-eight units of seed were sown.

Yield trials.—In the trials with strains 120 days in duration, E.C. 593 remained unexcelled. In the series for 110 days two strains E.C. 3858 and E.C. 3863 were superior to the standard E.C. 3517. In the former season also there were two yield trials, for the two durations 105 and 110 days. In both of these there were no new better strains to pick. New selections have been taken from fresh seed. With a view to evolve high yielding short duration strains, crosses were made last year between E.C. 3640 with a duration of 90 days and the 2 strains E.C. 593 (120 days) and E.C. 3517 (110 days). From this, four hybrid plants were raised. These were only 95 days in duration. A second generation will be raised in the coming season and from this, suitable selections will be taken. E.C. 1540 is a white ragi evolved from crosses made at the Millets Breeding Station. It has a very *high protein and vitamin content*, but is a poor yielder under Coimbatore conditions. To introduce the good qualities of E.C. 1540 into the current high yielding strains and thus enrich the diet, crosses were made between this and the other high yielding strains. At Anakapalli Ragi strain No. 525 in Punasa season did well with a grain yield of 2,669 lb. to the acre.

District trials.—In Ragi, E.C. 593 continued to be popular, 5,863 lb. of seed being distributed. In certain areas of Salem, Chittoor and Vizagapatam districts it has earned a good name as a rain-fed crop also. Two strains E.C. 3517 and E.C. 3735 which are shorter in duration than E.C. 593 by 10 days, were given out

for trial in the districts of Coimbatore, Salem, Trichinopoly, Chingleput and Chittoor. Good reports have been received about them from Trichinopoly, Salem and Chingleput districts. In first introduction as observation plots, they have done well in the Nellore, North Arcot and Tanjore districts.

(iv) *Korra*.—Three hundred and thirty-six units of seed were sown. In *yield trials* the local strain, S.I. 523 continued to be the best. With a view to a wider choice of seed material to suit the varying and localized conditions in the district, 1,094 single plant selections were made from the crops in the ryots' fields from 7 taluks, for further selection. In district trials S.I. 523 did well in Palladam taluk.

(v) *Pulses*.—Four hundred and ninety-nine units of *Cowpea* were grown. This includes the large African collection received from Kew. In *yield trials*, C. 521 from Tanganyika proved the best for grain. For fodder value, C. 422 gave the largest cut. In the *Garden Bean* the second batch of 40 varieties was sown and the 10 best were picked. With the fodder legume, *Berseem*, the first year's trial showed that Lucerne which is already established, responds better to cutting. The poor seed setting of *Berseem* is an added disability.

(vi) *Electro-culture experiments*.—Trials with treated and untreated Cumbu and Tenai seeds were repeated. There were no differences in yield between them.

(vii) *Seed distribution*.—From the Millets Breeding Station the following seeds were distributed during the year: Cholam strains (irrigated and rain-fed)—27,537 lb., Ragi—8,175 lb., Cumbu —1,746 lb., Tenai—156 lb., a total of about 38,000 lb. of all millet strains, representing the *primary wave* from the central station. This excludes seed supplied from the six district stations at which Millets Assistants are stationed for local work.

(3) *Potatoes*.

10. At the Nanjanad Agricultural Research Station in the Nilgiris, which is the only station on which research on this crop is carried out, the usual three crops were grown. They gave 17,325, 11,875 and 14,475 lb. per acre, respectively. The trials with hybrid strains mentioned in last year's report were continued. Trials of early and late varieties were also conducted. Experiments were also conducted to ascertain—

(1) the comparative yields of crops from cut seed tubers and whole seed—also the best method of cutting potatoes for seed purposes;

(2) the best method of sprouting seed tubers;

(3) the best position to plant tubers; and

(4) the effect of different methods of storing seed potatoes on the yield of the crop.

The system of manuring which has been finally adopted for this station is 5 tons of cattle manure per acre plus 1,610 lb. of the "Nanjanad Potato Fertilizer Mixture" composed as follows :—

	Per acre.
	LB.
Groundnut cake	500
Sulphate of Ammonia	200
Steamed Bone-meal	350
Concentrated Super	336
Sulphate of Potash	224
Total ..	1,610

(4) *Fibres.*

(*a*) Cotton.

11. Two generations of cotton—one at Coimbatore and the other at Srivilliputtur—were again raised in a single year with the object of speeding up the breeding programme.

Improvement of Cambodia cotton.—One hundred and fourteen American varieties were imported from different countries and tried on the Cotton Breeding Station. All of them were highly susceptible to jassids and unsuited to Coimbatore conditions. Such of them that were better in lint length and earliness were however utilized as parents for crossing with strain Co. 2. Nine hundred and twenty-five cultures were studied in F_2 generation and nine hundred and twenty-four cultures were grown in progeny rows. The progenies of the crosses between the two new strains X3915 and X4383 were more promising. It was found that in the multiple crosses the combination of economic characters was not stable in the succeeding generations.

In the yield trials of strains, strain X4383 did well during summer and cold weather sowings, while X3915 was best in summer only. These strains were compared with Co.2 and 920 in eleven other centres in the districts. X3915 was found to be superior only in Salem district. Strain 920 was the best in other districts.

The lint of X3915 was declared by the Director, Technological Laboratory, Bombay, suitable to spin 50's. It actually fetched a premium of Rs. 25 per 784 lb. over that of Cambodia. The growers consider that its introduction will benefit them to the extent of Rs. 25 per acre when raised as a summer crop. It was arranged to be grown over 1,000 acres of seed farm during the year. The performances of strain 920 in the districts for the past five years were examined and found to give on an average Rs. 8 per acre more than Co. 2, in spite of its lint being a bit shorter and coarser.

Improvement of indigenous cotton.—Sixty cultures were tested with K1 in the progeny rows, at the Cotton Breeding Station. Only six proved better than the control. A few of them had ginning

percentage of more than 31 and lint length over 32 mm. These should be considered as lucky finds since they may form the starting points for the evolution of long stapled strains even in country cottons.

The strains evolved in the Madras Herbaceum Scheme were tested with K1—the standard strain at eleven centres in the districts but none were equal to K1 in the consistency of behaviour indicating thereby that they were less cosmopolitan.

A new fully fertile tetraploid cotton was obtained by treating with colchicine a partially fertile cross between karunganni and an African wild cotton. It is found to possess finer lint than karunganni and to cross freely with American varieties. If this cross proves successful it will provide useful material for black soil tracts.

The seeds of K1 raised in different places in the southern districts were tested for a second time for the relative potential productivity with those raised at the Cotton Breeding Station with the object of verifying the farmers' belief about the superiority of K1 seeds obtained from Koilpatti. The trials showed that there was no foundation for the claim put forward in favour of the latter. It was proved in another set of trials that the greater drought resistant character attributed to the mixture of karunganni and uppam cottons was not true and that the growing of the mixture generally resulted in a loss as compared with the practice of sowing pure strains.

Application of electro-cultural treatments to cotton proved futile once again.

The following four schemes financed by the Indian Central Cotton Committee were run during the year :—

(a) *The pempheres scheme* was started in 1931, with the object of devising suitable measures for the control of stem-weevil (*pempheres affinis*). Only the botanical part of work was continued throughout the year. Infestation was phenomenally high at Coimbatore and led to very high plant mortality. Many cultures that were assumed to be resistant from the low record of mortality in the previous years broke down indicating them to be only pseudo-resistant. The degree of adult emergence continued to be, however, low in them. They showed that the conditions leading to the causation of the two features were not identical. The data pointed out the need for continuing the comparison of all the cultures for at least two more seasons.

The occurrence of unprecedentedly high infestation was also useful in isolating really resistant types from amongst those studied in the progeny rows. Moco parent was once again found to be most useful from the schemes' point of view.

The bio-chemical wing was closed on the 31st August. In the two months of its work the efficacy of B amylase component of the polysaccharide was studied for use as chemical criterion in the isolation of resistant types and the results were in harmony with the previous year's findings.

(b) *The Mungari Cotton Breeding Scheme* was worked for the third year with the object of evolving medium stapled strains suitable to replace the short staple mungari cottons in the Ceded districts. The experiments were conducted in two separate blocks of land leased to represent mixed and red soils of the tract. In the yield trials, strain V434 of the Central Provinces and 6042 of the Madras Herbaceum Scheme were equally good on both soils while Cambodia strain X4383 was the best on the mixed soil only. Strain H1 of the Westerns' cotton was the poorest showing thereby its unsuitability to mungari conditions. The trials carried in the districts pointed that strain V434 was equal to control in all the centres while X4383 was distinctly inferior in two places due to its greater susceptibility to thrips. A review of three years' performances in the district revealed that strain V434 would be a safer strain for spread in that area, but its lower ginning percentage would be against it.

(c) The Nadam Breeding Scheme was in the sixth year of its run. It was started with the object of evolving annual strains to replace the perennial Nadam cotton grown on the red soils of Coimbatore and Salem districts. The rainfall, though more than normal, was badly distributed. As a consequence the growth of the cultures raised in experimental plots was not satisfactory. In the yield trials strain karunganni K1 and two strains evolved in the Madras Herbaceum scheme were the best. These strains would have to be tested in larger plots with and without cereals. The behaviour of Americans was found to be errative.

(d) *The Cocanadas Breeding Scheme* was sanctioned recently by the Indian Central Cotton Committee for improving the yield, ginning percentage and colour of the commercial Cocanadas cotton. It was started on 1st February 1940. A botanical survey of the types grown in Guntur, Nellore and Kistna districts was made and material suitable for breeding purposes was collected. It was observed that this cotton is being grown on soils ranging from poor, shallow red, to rich deep black soils and as such it would be necessary to arrange breeding plots on both classes of soils. It was further observed that there was not much plant variability in the tracts and that all highly coloured biotypes were shorter in lint length.

Miscellaneous.—The Indian Central Cotton Committee, Bombay, held its forty-first meeting at Coimbatore. This opportunity was availed of to take the members round the cotton breeding station and to explain to them the nature of the work done on the station.

(*b*) Sunnhemp.

Research on Sunnhemp fibre was continued for the third year under a scheme subsidized by the Imperial Council of Agricultural Research. Owing to seasonal conditions the growth of the crop was so bad that results were of little value. The experiments on the retting and bleaching of the fibre tended to confirm the results referred to in the report for the previous year.

(5) *Sugarcane.*

12. (i) *Agricultural Research Station, Anakapalle.*—In the yield tests to ascertain the best variety of sugarcane, Co. 419, yielded the maximum outturn of 55·44 tons of millable cane per acre. The same variety proved also eminently suitable for water-logged or swampy conditions of cultivation attendant on the cultivation of sugarcane in the midst of wet land paddy. The well-founded popularity of Co. 419, in the district is therefore bound to increase. The utilization of wire for propping sugarcane yielded good results and was not banned by consideration of costs. The 'heap' method of preservation of cane seed-material appeared to be the best, while the optimum period of such storage was fifteen days.

(ii) *Sugarcane Research Station, Gudiyattam.*—Variety Co. 419 performed very well at this station also, yielding 58 tons of millable cane per acre. Co. 421 gave promise of good yield combined with early maturity. An investigation into the economic limits of ratooning indicated that it was unprofitable to go beyond the second ratoon crop, although drop in yield may be staved off by judicious enhancement of the manurial regimen.

(6) *Fruit.*

13. (*a*) *Kodur Fruit Research Station (Cuddapah district)*—(i) *Citrus.*—It is well-known that, next to parental influence, the rootstock variety used for budding exerts perhaps the most determining effect on tree performance. During the first 18 months of orchard life, it was found at Kodur that jamberi and gajanimma root-stocks produce the largest sized sathgudi orange trees. Kichili and lime form the second most vigorous group of rootstocks, with billikichili, grape fruit, sour orange, country orange and santra coming next in importance, and sweet orange, mandarines and pummelo rootstocks and unworked sathgudi seedlings producing the smallest sized orange plants. Jamberi has also proved to be the most vigorous rootstock for lime upto the first 18 months of orchard life and lime rootstock the least vigorous, with gajanimma rootstock and unworked lime seedlings ranking intermediate between

the two extremes. It was also found that the differences in orange tree vigour observed between three grades of kichili and jamberi rootstocks prior to planting tend to level out at a very early stage of orchard life. From these and the results obtained from a separate trial with sathgudi oranges, it is concluded that a rigid selection of seedlings in citrus seed and nursery beds for producing vigorous scion trees is a futile practice. Electro-culture consisting of jacketing, sparking the jackets and irrigating with sparked water had no beneficial influence on young lime seedlings trees up to about 18 months after the commencement of the trial. Observations made in the variety collection area at Kodur have revealed that four varieties of lemons, one of kumquats and two of pummeloes possess sufficient merit to strike the fancy of the growers.

Root studies on seedlings of jamberi, gajanimma, kichili and khatta and on budded orange trees on these rootstocks were in progress during the year, and the findings confirm in a large measure those obtained in previous years. These have been helpful in determining the optimum spacing for trees on different rootstocks and in finding out the exact zone of feeding roots, which requires to be fed and watered for maximum tree growth and performance.

(ii) *Mango.*—Studies during the year at Kodur have confirmed that ten mango varieties of the West Coast are polyembryonic, producing in some cases as many as five seedlings per seed. Contrary to the popular belief, it has been found that some of the polyembryonic varieties produce a very high germination percentage.

A trial to ascertain the rootstock potentialities of polyembryonic mangoes for Neelum and Baneshan has been initiated. Side-grafting, when performed in open beds in a suitable season with scion wood of 0·5 cm. diameter or over from apical region has produced a very high success of about 94 per cent. With this method it was possible to raise successfully some grafts with scion wood obtained from long distances and inserted 3 to 5 days after separation from parent trees—an achievement known to be impossible by the prevalent method of inarching. From budding trials it is concluded that Neelum and Erramulgoa are most suitable for this method of propagation giving a success of 71·06 per cent and 61·11 per cent respectively in certain seasons. Alfonso and Bangalora produced, however, relatively poor success by budding. Cleft-grafting proved almost a total failure, while the success by root-grafting has been very encouraging. To determine the extent of uniformity and nature of tree performance as influenced by various propagational methods, a trial has been laid out with Neelum and Bangalora scion varieties. In a trial with double-worked mangoes of four varieties it is intended to study if the shy-bearing but superior-fruiting varieties can be made to increase their crop-size by employing a productive variety as intermediate root-stock. Selection of Neelum grafts on relatively older root-stocks has again been found to have no practical value. Progenies

of 15 single tree selections of Rumani and Neelum characterized by off-season bearing tendencies have been planted. A number of selections of early and late fruiting varieties, double, triple and off-season croppers and also of superior-fruiting varieties has been made. The relationship between certain pre-fruiting characters and productivity in mangoes has been established, and suitable pollen parents for some cultivated mangoes have been determined. F1 progenies from 17 different mango crosses have been raised. The relation between the proportion of perfect flowers in the panicle and fruit-set has been confirmed. Descriptions of 328 mango varieties and their classification are nearing completion, and this work has helped in unravelling the chaos that prevails in mango nomenclature.

Miscellaneous.—Six inbred strains of papaya have been obtained from South Africa and planted along with five inbred strains produced at Kodur.

Work on fruit canning and products has been in progress on a small scale. Among the good quality products prepared are canned pine-apple slices, candied citron peel, candied kumquats and mango squash, cordial and carbonated beverages of limes and lemons and a breakfast food from wild fig.

A cheap grading machine for sathgudi oranges has been devised, and this grades 3,500 to 4,750 fruits per hour into four grades. Pine-apple 'eye' extractors and nursery transplanters devised at Kodur have proved their usefulness.

The Government Fruit Nursery at Kodur sold 2,253 budded citrus plants, 2,312 mango grafts and 1,445 other fruit plants during the year. The actual receipts from the scheme have amounted to Rs. 3,601–12–11. On a fair valuation of assets of all kinds, the scheme may be considered to be already a remunerative concern. A number of possible improvements in nursery production have come to light. Twenty-one students were given training in propagation methods, and 6,100 citrus buds were inserted in 12 different places in response to requests from private persons. Within almost a year of the commencement of the scheme and as a direct result of the work under the scheme, no less than seven private citrus nurseries have sprung up and a large number of fruit growers have undertaken to raise their own plants on the lines advocated by the Fruit Research Station, Kodur.

(*b*) At Coimbatore the Assistant in charge of the Herbarium made a banana survey in the districts of North and South Arcot. The morphology of fifteen varieties was studied.

(*c*) At the Pomological Station, Coonoor, 47 have grafted plums and pears and 20 fruit seedlings consisting of Cherimoyer, Surinum cherry, lemon and tree tomato were planted during the year. On account of severe drought from December to March the fruit crop was not large amounting only to 6,129 lb. One thousand one hundred and eighteen apples, peaches, pears, etc., were successfully budded or grafted and 1,078 seedlings and plants were raised.

(*d*) At the Burliar Fruit Station the total yield of fruits and spices was 5,702 lb. and 255 lb. respectively. One thousand five hundred and five seedlings of clove, mangosteen, litchi, durian, langsat, bread-fruit, etc., were raised during the year.

(*e*) At the Kallar Fruit Station 6,200 lb. of fruit of all kinds were harvested. Six thousand two hundred and fifty plants of orange, sapota, mangosteen, rambutan, litchi, custard apple, lemon, bullocks heart, clove, etc., were raised.

(*f*) Research work was also in progress at Anakapalle, Samalkot, Guntur and Taliparamba stations. At the last named nursery work was expanded, 4,200 graft mangoes and other fruit plants being sold as against 1,491 last year.

(7) *Oil-seeds.*

14. As in previous years research work on oil-seeds was confined mainly to groundnuts, gingelly, castor and coconuts. The work on groundnut and coconut was continued to be financed by the Imperial Council of Agricultural Research.

(*a*) *Groundnuts.*—The improved varieties, viz., A.H. 25 (spreading), A.H. 32 (bunch), and A.H. 45 (erect) continued to gain popularity both within the Presidency and outside. The large demand for seeds was met as far as possible from Tindivanam and other district farms and by arrangement with cultivators.

In groundnuts, the problem is to evolve strains suitable for different localities and combining high yield and best quality of the produce as determined by a high oil content, low free fatty acids, a high proportion of kernels to pods, etc. These qualitative characters are to a certain extent controlled by the rainfall and its distribution thus rendering the work of the breeder rather complex. Attempts are under way to evolve strains satisfying particular conditions and three promising selections that give as much yield as A.H. 25 but shell better, have been recently singled out for trial in the districts.

(i) *Yield trials.*—In the varietal trials, A.H. 32 proved to be the best of the bunch varieties both in yield and qualitative characters, while in the spreading, A.H. 3849 a mass selection from a newly introduced variety gave an increased yield of 10 per cent over the local. Six bunch and twenty spreading selections were under final comparative trials. Four of the former were on a par with the control. Among them, A.H. 218 and A.H. 1192 alone came up to the standard of the control in qualitative characters. All the spreading selections yielded more than the control, the percentage increase ranging from 12 to 49. Eleven of these were on a par with A.H. 25 in yields, and also superior to it in shelling and other qualitative characters. Five of the selections, viz., A.H. 338, 675, 677, 678 and 692 have come up to the level of A.H. 25 in yields for the second time. In the preliminary trials, nine

selections recorded significant increases in yield. Out of a total of 1,579 selections under row tests, 797 were picked out for further trial.

In the district trials at Pollachi four selections gave increased yields over the local. Of the five short duration selections tried at Guntur, A.H. 218 gave the highest acre-yield of 1,889 lb.

(ii) *Hybridization.*—Eighteen crosses have been newly obtained for economic purposes. The progenies of cycle crosses previously made were studied for isolation of desirable types.

(iii) *Effect of climate and soil on groundnut.*—The second year's trials under this scheme were conducted at thirty agricultural research stations in the various Provinces and States in India. In thirteen places the strains gave significantly higher yields than the locals, the increase ranging from 12 to 94 per cent. There was wide variation in the qualitative attributes of the strains due to the effect of climate and soil. The shelling percentage varied from 58·5 to 80·1 and the oil percentage from 41·4 to 55·9.

(iv) *Manurial experiment.*—The manurial experiment on groundnuts to study the effect of the application of ammonium sulphate at the rate of ½ cwt. per acre, superphosphate at 2 cwt., and potassium sulphate at 1 cwt., with and without a basal dressing of 3 tons of cattle manure, and in their different combinations was pursued for the third and final year. Potassium sulphate gave increased yields all the three years, while superphosphate did so in two years. The other treatments were not effective.

(v) *Pure cropping of groundnuts* versus *mixed cropping.*—The economics of raising mixtures was compared with the cultivation of pure crop of groundnut. Mixed cropping with redgram, castor, cotton or cholam was found to be more remunerative than the pure crop.

(*b*) *Gingelly.*--The improved variety S.I. 89 gave increased yields over the locals in the district trials conducted in South Arcot, Chingleput and Tanjore. It was in great demand by the ryots.

(i) *Yield trials.*—Four varieties and four selections were tried both during the summer and the cold weather seasons. Selections 897, 877, 6–2–133–1 and 38–12–14–1 were found to be the most promising giving increases of above 10 per cent over the local. S.I. 877 gave a maximum yield of 684 lb. per acre and was also highly resistant to shoot webber pest and wilt disease.

(ii) *Single-plant selections.*—From the collection of varieties, fifty economic single plant selections were made.

(iii) *Hybridization.*—The cyclic crosses between six economic types were repeated as the seeds from the first set failed to germinate. F_2 families of nine crosses were studied and 200 single plants with economic characters selected.

(*c*) *Castor.*—There was a marked increase in the demand for seeds of high-yielding castor types consequent on the rise in prices after the commencement of the war. Available quantities were distributed from Tindivanam. The number of enquiries with regard to the cultivation and economics of this crop showed also a perceptible increase.

(i) *Yield trials.*—At Tindivanam, of the twelve selections under trial, two gave significant increase of 15 per cent over the local. Of these, R.C. 642/4 (Thana) was also found to be shorter in duration by about one and a half months. At Coimbatore, R.C. 59–8–30 and R.C. 215 gave yields of over 1,000 lb. of beans per acre. Their oil content is nearly 52 per cent.

(ii) *New varieties and selections.*—Fourteen new varieties were studied and selection of desirable plants was made. Seed multiplication of 32 types selected in the previous years was carried out.

(iii) *Inbred and horticultural types.*—One hundred and thirty-six different types were maintained as a nucleus for breeding work. The six horticultural types were grown for seed multiplication.

(iv) *Hybridization.*—Sixteen economic crosses were newly made. Thirty-three economic types were singled out from the progenies of crosses.

(v) *Perennial castor.*—In connexion with the scheme for the stimulation of castor cultivation on the Nilgiris, a study of the perennial castor growing on the hills and in the plains was made. This form of castor is seen to thrive under varying conditions of climate and rainfall and also at different altitudes. Of the many types met with, only a few were economic. The oil content varied from 43·2 per cent to 56·3 per cent.

(*d*) *Coconut.*—The appreciation of good planting material by the public was revealed in the increasing demand for pedigree seed-nuts and seedlings. This was met by the distribution of all the available quantities from the coconut stations on the West Coast.

(i) *Preservation of seed-nuts.*—In conformity with previous observations, it was seen that seed-nuts could be preserved without drying up in a heap of sand. During a period of six months of such storage, 83 per cent of the nuts remained good at Kasaragod and 65 per cent at Tindivanam. The untreated nuts had all become unfit for sowings in the same period.

(ii) *Germination studies.*—There was no difference in the percentage of germination between nuts, 13, 12 and 11 months old. But the 13 months old nuts took a longer time (167 days) to germinate than 11 and 12 months old nuts which took 117 and 120 days respectively.

The nuts borne on the top of a bunch gave lesser percentage of germination (70 per cent) than those at the middle and bottom which gave 100 and 92 per cent respectively.

(iii) *Manurial experiment.*—The experiment to determine the most economic dose of ammonium sulphate was in progress.

Observations on the effect of burial of coconut husk and leaves in trenches between coconut trees were continued. At Pilicode a higher setting percentage of female flowers was perceptible due to the treatment, and yields equivalent to those obtained from a general dose of 3 lb. of ammonium sulphate *plus* 1½ lb. of potassium sulphate, *plus* 2 lb. of bone-meal per tree were also obtained. At Kasaragod significant increase in setting percentage and the number of functioning leaves was noticed.

(iv) *Copra and coir studies.*—Copra studies in relation to age of nuts repeated during the year confirmed previous results. Nine and 10 months old nuts are unfit for copra and oil production both from the point of view of quantity as well as quality. In a preliminary study, the quantity of coir fibre obtained from husks of 9, 11 and 12 months old nuts was found to be the same but was greater than that from 10 months old nuts. There was no difference in the length or thickness of fibre in the different age groups except the 12 months which gave slightly shorter length.

(v) *Breeding.*—The hybrid trees from the cross between the tall and the dwarf types of coconut which came to flower last year have begun to yield. These combine the earliness of the dwarf parent and the economic characters of the tall and thus appear promising.

The progenies from crosses in coconuts were seen to be superior to the natural and selfed ones and the natural superior to the selfed.

(*e*) *Electro-culture.*—Various treatments mentioned previously were continued on coconut and groundnut but no effect due to these was perceptible.

(8) *Spices, condiments and narcotics.*

15. *Chillies.*—The search for a strain resistant to the attack of the insects known as thrips continues. A large variety of types both from this Province and from outside have been sown this year. Eight bulks, viz., Coimbatore, Udamalpet, Vellore, Nallapadu, Pusa T. 34, Nagpur T. 16, Dinajpur City and Tobaxo were used as male parents for crossing with 398 (Farm strain) and Nallapad and Mavella, the local bulks. Previous cultures were under comparative trials.

Pepper.—At Taliparamba manurial experiments have been carried on for ten years in two series of plots, one limed and the other not limed. There was a uniformly lower yield in all the unlimed series but it is difficult to give any strict statistical interpretation of the other results as there were wide variations between duplicate plots in the same season.

Ginger.—Five years' trials at Taliparamba indicate that the local variety (Ernad) is not inferior to the Bengal and Trinidad Canton varieties.

Tobacco.—Work on tobacco is being carried on at the Guntur Research Station (Lam Farm) which is in the centre of the area where Virginia (cigarette) tobacco is grown. In this tobacco 23 cultures selected in the previous year on the basis of yield, earliness, freedom from mosaic disease, size, body and colour of leaf were tested in rows with Harrison Special as control. Eleven cultures were better than the control and will be tested further. Some work on cigar tobacco was also done. Pipe, beedi and hookah tobaccos from outside Guntur were also planted but it was found that they did not take kindly to Guntur conditions.

(9) *Miscellaneous crops.*

16. *Soy beans.*—From a study of the results of trials during the past years it is found that soy beans have done best only in the Godavari and Cauvery deltas with deep alluvial soil and an annual rainfall of 40 inches and over. It was a fair success in Coimbatore in garden lands as an irrigated crop but failed when grown as a purely rainfed crop. The crop seems unsuited both as a rainfed and irrigated crop in the Ceded districts. It is only a partial success in Guntur. As a rainfed crop it has been successfully grown in Maruteru (West Godavari), and Aduturai (Tanjore) Agricultural Research Stations. In other places it has not been successful and was highly susceptible to "Surul" poochi. During the year under report the crop on the Agricultural Research Station, Aduturai, did not put on satisfactory growth owing to the continuous heavy showers of the North-east monsoon. At Maruteru an yield of 1,140 lb. of Behrum and 1,000 lb. of Penygpe varieties of seed per acre was obtained.

17. *Pyrethrum.*—At the instance of the Imperial Council of Agricultural Research, Pyrethrum is being tried at the Government Botanic Gardens, Ootacamund, Pomological Station, Coonoor, Agricultural Research Station, Nanjanad, and in private lands at Kotagiri and Yercaud. A few ounces of seed were obtained from the Imperial Council of Agricultural Research in the years 1937 and 1939 and distributed to these places for trial.

At the Government Botanic Gardens, Ootacamund, 700 plants were raised in 1937 and transplanted. The plants begin to flower only in the second year and 7 lb. 10 oz. of flowers were collected in June 1939 and this quantity gave 1 lb. 10 oz. of dried stuff. Five ounces of seed were also collected. Half an ounce of this seed was sown in June 1939. The acclimatized seed gave better germination than the imported seed. Eight hundred and thirty seedlings were transplanted.

At the Pomological Station, Coonoor, a few plants were obtained from the Government Botanical Gardens, Ootacamund, in June 1939. About seven seedlings are growing satisfactorily.

At the Agricultural Research Station, Nanjanad, 1½ tolas of seed were sown over half a cent in August 1939. The germination was poor. Five hundred and fifty seedlings were subsequently obtained from the Botanical Gardens, Ootacamund, and transplanted.

At Kotagiri ¾ oz. of seed was sown in July 1937 on a leased land. Five hundred seedlings were raised and transplanted. To see how planting of slips would thrive bushy seedlings were divided into slips and planted. About 8 cents were planted on a field scale in November. The crop put on a vigorous growth. In all 3 lb. of flowers were collected which gave ¾ lb. of dried stuff.

In Yercaud a small quantity of seed was sown in July 1937 and seedlings were transplanted in an area of 1/16 of an acre. The plants did not put forth flowers and the trials are not encouraging.

Three samples of flowers from Emerald Valley, Coonoor, and Kotagiri, were sent to the Government Entomologist for trial as an insecticide.

The flowers were powdered and used against caterpillars *Prodenia litura* and *Phetella maculipennis*. The material from Kotagiri caused the highest mortality in the trials.

There was demand for seed from several planters in the Nilgiris, Travancore and Mysore States for trial on the hills and estates.

(10) *Dry Farming Research, Hagari.*

18. The Dry Farming Scheme at Hagari has been in progress since 1934 and is being carried on under the direction and with the assistance of the Imperial Council of Agricultural Research as a part of a joint programme of research work undertaken in co-operation with the Governments of Bombay, the Punjab and Hyderabad State. Research is being conducted along the following lines :—

(1) Soil Physics,
(2) Physiological Studies,
(3) Agronomy, and
(4) Crop Improvement.

These compartments are of course not water-tight. For example, any new cultural methods tried in agronomic research naturally provide the Soil Physicist with material for soil moisture determinations, etc.

In the year under report, studies in physiology have been mainly directed to root studies and the study of the effect of a peculiar " hard layer " which in the black soils at Hagari develops in the course of the cultivation season in the first foot of the soil.

The root studies on Sorghum once again corroborated that the compact-panicled types have a comparatively greater lateral spread, while the loose-panicled have their roots going deeper than the former. Doses of farmyard manure, 6,000 lb. and 9,000 lb. per acre, clearly promote the development of roots, as compared with the unmanured; but there is not much to choose between the two doses. The manured plants have once again been earlier and a considerable economy of water is in evidence. Wind above a velocity of 10 miles per hour is harmful to the Italian millet.

Studies on the development of hard-layer in the top foot of the soil were continued. Since the season was favourable this phenomenon was noticed later in the season. Experiments with artificial pressure on the roots of the cotton plants to stimulate the pressure caused by the shrinking of the clayey drying soil were continued, which corroborate the previous year's observations that the hard-layer formed strangulates the cotton roots, consequently the wilting of plants.

On the agronomical side, research has been directed to the effect of fallows and various systems of tillage and also to the effect of operations like bunding and scooping.

In this year of good *hingari* rainfall conditions the bunding has not produced striking results. Due to water stagnation in the lower levels of the compartments when the crop was young there has been seedling deaths, and this has caused lesser yields of cotton and Sorghum straw, yet with lesser number of plants the Sorghum grain return has been 25 per cent more in the bunded. Cotton responds to fallowing far more than Sorghum. The benefit of a fallow even two years ago was visible on cotton, but was not so in similar plots grown with Sorghum. The residual effect of organic manure has been visible even in the fourth year. Among the treatments compared to get at the optimum dose of farmyard manure, only the 9,000 lb. per acre dose was significantly superior to the 5,000 lb. in the case of the direct effect on cereals. In the residual effect studies with cotton the 3,000 lb. dose was equal to ' no manure.' Here again only the 9,000 lb. dose was superior to the 3,000 lb. dose, the other variant with 6,000 lb. dose being equal to the latter. The interculture experiment with cotton has once again shown no differences in yields. With Sorghum the experiment has had significant results in straw return only, the ' five intercultures ' being superior to all except ' four intercultures.' The latter is better than the ' no interculture—no weeding ' which always records the lowest yield.

The strip-cropping for a first year has shown that cotton plants in strips have double the growth of those in the Korra-cotton mixture.

Similar work is being done on red soils in Anantapur district. Of the cultural experiments conducted here significant results were obtained only from two. Where the effects of the 5, 7 and 9 inch high bunds were compared, the 5-inch bunded plot gave higher yield than those from the other bigger bunded. Again in an experiment where the ploughing 3 inches, 4½ inches, 5½ inches and 7 inches deep were compared with the respective implements the plots ploughed 7 inches deep with the Cooper No. 21 have yielded the highest return of groundnut, the extra cost of deeper ploughing being economic.

D.—Plant Pathology.

19. (i) *Work of the Government Mycologist.*—The primary aim of the investigations of fungus diseases of plants is to find out effective, cheap and practicable methods for the control of diseases which cause immense loss to the cultivated crops. With this aim in view the investigations started in previous years on some of the important crop diseases were continued. In the case of the 'blast' disease of rice, studies in varietal resistance under field conditions at Coimbatore were continued. Forty strains of rice were studied and of these Co. 4 was found to be immune and twelve other varieties showed neck infection less than 10 per cent as against a percentage of 70 of the most susceptible variety. Co. 11 and two new selections 11348 and 10998 obtained from crosses of Adt. 10 and G.E.B. 24 are among the highly resistant strains. The fungus (*Piricularia oryzae*) was found viable for 15 months in diseased specimens of the infected plant collected and preserved in the laboratory. This shows the possibility of fresh infections from old stubble and straw. Further studies of the life history of Helminthosporium disease of rice and inoculation experiments were made. Successful infections were obtained on two to ten week old rice seedlings. The difference in the age of the seedlings had no influence on the amount of infection obtained but a humid atmosphere was found conducive for the development of the disease. The fungus was found capable of infecting leaves and ears of tenai, wheat and barley and leaves of maize and also wounded leaves of cumbu and sorghum. Infected seeds and soil were found to be sources of infection and the maximum amount of infection was when both the seed and soil were infected. The fungus dies at 51°C for an exposure of 10 minutes showing the possibility of avoiding seed infection by hot-water treatment. In the investigation regarding the incidence of ragi blast in relation to time of sowing it was found that the crops sown in June, July and August suffered heavy infection and the infection was directly related to the high humidity prevailing at the time of heading and maturity. In the resistance trials none of the 12 varieties tried

was found to be immune. In the cross inoculations carried out with the Piricularia strains from ragi, tenai and rice, the ragi and tenai strains were found to infect ragi, tenai, wheat, oats, barley, maize and a grass (*Dactyloctenum aegyptium*) but not rice. The rice Piricularia was found to infect all these except ragi. Field experiments for the determination of the economic strengths of Bordeaux mixture for the control of Mahali of areca palm are again repeated this year in Mundaji village, South Kanara. Useful results regarding the oospore formation in paired cultures were obtained. Arecanuts inoculated with *P. meadii*, *P. palmivora* and *P. parasitica* were not infected suggesting that the areca strain is specialized. For the control of redgram wilt, seeds treated with Ceresan are under field trial. To study the varietal resistance to wilt fifty-four selections of redgram are under trial. Regarding groundnut wilt experiments in connexion with soil and seed treatments, varietal resistance and incidence of disease in relation to time of sowing are in progress. Inoculations with two strains of the red-rot fungus (*Colletotrichum falcatum*) were successful on sugarcane varieties Poovan, Co. 419, Co. 421, *Saccharum spontaneum* (local and Galagah) and wounded leaves of maize. Sett inoculation through bore holes and soil inoculation produce shoot infection in due course. From the study of the spread of infection in relation to temperature, it was found that strain No. 1 spreads more rapidly than strain No. 2 at temperature varying from 15°—34°C and the maximum spread was found to be between 30° and 35°C. The spores of both the strains are killed by an exposure of five minutes at 51°C. Successful infection was obtained on sorghum seedlings and wounded mid rib of sugarcane leaves with the fungus *Colletotrichum graminicolum* isolated from diseased sorghum leaves. Investigations on seedling blight and boll-rot of cotton due to *Colletotrichum indicum* showed that the presence of the fungus in the soil can kill cotton seedlings. The temperature most suited for infection was found to be between 20° and 30°C. Germination of the seeds infected with the fungus was found to be seriously affected. Seed treatment with Ceresan was found to be successful in controlling seed infection. Ceresan was not successful in controlling soil infection when there was heavy rain at the time of sowing. When there are no rains the treated seeds gave good results. Pot culture experiments showed that the disease occurs in soils containing 30 to 50 per cent moisture. Comparative studies of *Colletotrichum indicum* with other strains and species of Colletotrichum were made and interesting results have been obtained. Spraying trials for the control of the abnormal leaf fall and fruit-rot of oranges in the Wynaad showed that a single spraying with 1 per cent Bordeaux mixture after the onset of the monsoon and just at the appearance of the first signs of disease can check the disease effectively. To confirm the results, the experiment is being repeated. Ginger rhizome rot is a serious disease in Malabar. Seed treatment with Ceresan before planting

was found to control the disease. Seeds treated with 0.1 per cent mercuric chloride solution were found to be effective in reducing loss during storage.

Studies on virus diseases were continued. Field trials to estimate the relative resistance of 16 sugarcane varieties to mosaic were conducted. Co. 205 (Pusa) and Co. 434 continued to show resistance. Uba (S.H. 38) and Co. 422 have been free during the two years they have been under trial. Insect transmission of the disease with *Aphis maidis* and *Toxoptera graminis* was not successful. A sterility disease of cotton, " little leaf " of brinjal and cardamom mosaic were the other virus diseases studied and useful results obtained.

20. (ii) *Work of the Government Entomologist.*—Three hundred and five enquiries from all over the Presidency were dealt with by the Government Entomologist at Coimbatore. The enquiries related mainly to insect pests of crops and their control and bee-keeping. Other enquiries were dealt with by his assistants attached to administrative circles.

The problems under investigation covered subjects such as control of crop pests, bee-keeping, study of the toxicity of indigenous and foreign insecticides to various insect pests and systematics of insects.

(*a*) *Crop pest control.*—The services of the natural enemies of insect pests have once again been utilized in the fight against them. The chalcid parasite—*Aphelinus mali*—which has a world reputation for very efficient control of the wooly aphis (*Eriosoma lanigera*) was imported and is being bred at Coonoor for liberation into the infested apple gardens. The possibility of control of the coconut beetle grubs (*Oryctes rhinoceros*) with the aid of its natural enemy—the green muscardine fungus—is being intensively studied under experimental conditions. Similarly the study on the possibility of control of the cotton stem weevil (*Pempheres affinis*) with its parasites is being continued under a special scheme of the Indian Central Cotton Committee. Cultural methods were employed with advantage against the ' Ber ' fruit fly (*Carpomyia vesuviana*), the fruit-sucking moths (*Ophideres spp.*), tobacco nursery moths (*Laphygma exigua*). The fruit fly is known to pass a considerable period of its life cycle as pupæ in the soil. Raking up of the soil beneath the infested fruit-trees for the destruction of the pupæ proved helpful at Panyam in reducing the pest. Trap cropping with ragi for the tobacco nursery moths has given encouraging results. Trap cropping with tomato for luring the fruit-sucking moths from citrus fruits is being studied. Experiments on the control of sugarcane moth borers by earthing up of canes followed by irrigation have been once again repeated and are in progress. Control by mechanical method, viz., collection of eggmasses of sugarcane moth borer (*Argia sticticraspis*) has not proved economic

and will have to be abandoned. Systematic removal of coconut beetles from trees and sanding the beetle grubs in the manure pits with the green muscardine fungus give good control of the pest. The setting up of light traps in the fields during the season for attracting the paddy stem borer moths (*Schoenobius incertellus*) and the groundnut 'surul' moth (*Stomopteryx nerteria*) has proved to be of definite advantage in securing large catches. But how far this method would prove to be an economic proposition in securing effective reduction of the pests, is being investigated. Experiments with different treatments on the control of the cardamom thrips (*Taeniothrips cardamomi*) have indicated the superiority of tobacco decoction spray (0·02 per cent) in reducing the scab injury due to thrips. Varieties of sugarcane, groundnut and chillies were tested for resistance to insect pests with a view to help the breeder in the evolution of strains having a great measure of natural resistance in them. Electro-culture has failed once again to be helpful in the control of pests in general.

(*b*) *Study of the toxicity of indigenous and exotic insecticides to various crop pests.*—Pyrethrum dusts were found highly toxic to *Prodenia* and *Plutella* caterpillars; dusts of *Derris elliptica* were found to possess a high insecticidal value against *Epilachna* beetles and garden pests. Cooper's special spreading sulphur was found effective on *Pseudococcus* virgatus nymphs when dusted on the infested foliage. Acorus and Derris were found efficacious against the pests of paddy in storage. Neem leaves were not efficient against the pests of stored grains.

(*c*) *Systematics of insects.*—Identifications of insects in the Agricultural Research Institute collections and those received from outside and the study of the taxonomy of insects of the various economic families formed the chief items of the work. Besides, unidentifiable material was sent to specialists abroad for correct determination. In this way several insects new to science and new to the collections were discovered.

(*d*) *Quarantine service.*—During the year, 75 samples of seeds, bulbs, etc., intended for countries abroad were fumigated against pests and pest-free certificates issued.

E.—Bee-keeping.

21. *Bee-keeping.*—Bee-keeping continues to become increasingly popular. As many as 5,019 hives are being maintained throughout the Presidency as against 2,892 of last year. From the studies made on the extraction and preservation of rock-bee honey with the three appliances that were devised, honey extractor was found to be easily the best. Artificial ripening and storage in clean air-tight receptacles were found essential for preservation of the honey. It is now possible to meet the demand for comb foundation sheets with the aid of the newly imported comb foundation mill. Research on various aspects of bee-keeping was continued.

F.—Implements.

22. *Ploughs.*—Experiments started about two years ago to make this Province self-sufficient in respect of production and supply of improved agricultural machines and ploughs, have begun to bear fruit with the approval of the two types of ploughs, P.S.G. Nos. 16-A and 16-B manufactured by Messrs. P.S.G. & Sons' Charity Industrial Institute, Peelamedu, Coimbatore. Yet another type made by the same makers and approved for sale and demonstration after a number of experiments by this department is the P.S.G. No. 10 which is marked at a very cheap rate of Rs. 3-10-0 each, the lowest price for a small improved iron plough,

In view of the difficulties experienced for obtaining spare parts for foreign-made ploughs, arrangements have been made for their manufacture locally with the same works. This has helped to keep these ploughs at work which otherwise would have remained idle and caused disappointment to their owners.

The demand for improved ploughs and implements continues and the large quantity of spare parts sold is indicative of their good use and popularity.

Several field tests were conducted under widely varying conditions with the large sized adjustable double mouldboard plough designed by the section last year. Minor modifications have since been effected and it will be tested again for constructional and field performances.

Cultivators.—Field experimental trials connected with the five-tyned expanding cultivator was continued in the districts and these have resulted in the further strengthening of the tyre carrier bars. It is now being demonstrated with satisfaction.

Puddling implement and green manure trampler.—Slight alterations were carried out to the original design to make it light and to get over the clogging tendency in highly sticky puddles. The latest design works more satisfactorily and there is a growing demand for it. Twenty-two implements were sold to ryots during the year. Twenty-one disc tramplers for green manure trampling were purchased for private landholders during the year and both these new implements are slowly being appreciated and becoming popular.

Guntakas.—Different designs of guntakas with straight and curved blades and piercing points were tried for groundnut harvesting. Their performances have been noted for future studies and work is in progress to evolve a cheap and efficient guntaka for lifting groundnuts.

Mechanical seed drill.—The four-tyned light mechanical seed drill was demonstrated with some more fresh improvements for

sowing paddy, groundnut, cotton and cholam. Ryots are now able to appreciate its efficient performance and a few were purchased by well-to-do persons in other districts as well as Coimbatore where it was demonstrated first. The demonstrations are now spreading out in the districts of Salem, Chingleput and South Arcot.

Turmeric polishers.—From the experience gained out of the large number of demonstrations, the effective rubbing surface has been increased by the provision of expanded metal and wire gauze sides for the rotating barrel and this has proved better than the older models. The machine is in increased demand from almost all the turmeric growing areas of the presidency. A medal was awarded to it by the Imperial Council of Agricultural Research, New Delhi.

Water lifts.—Another medal was awarded for the improved circular mhote entered for the open competition of the Imperial Council of Agricultural Research for water baling appliances. As it is only suitable for shallow wells, there is only a small demand. but Persian wheels of the types approved by the Engineering Section have a wider appeal and 40 wheels were erected during the year.

The hand fertiliser distributors made by this section were demonstrated in the Nilgiris and some were sold to potato growers.

A new type of hand power decorticator styled Chinese groundnut decorticator was obtained for tests from Nagpur. It has been improved here and is awaiting trials in the groundnut tracts.

The section was useful to the other officers of the Institute in preparing and testing a variety of apparatus required for their work and also to the District Officers in designing the special types of implements needed for certain special conditions.

G.—Trial plots.

23. New strains of crops evolved at the Agricultural Research Stations are tested in trial plots in ryots' land to find out their suitability to different tracts. Such trials are carried out for a period of three years under local conditions with a number of replications. When the results are significant over the locals, the new strains are passed on for multiplication and distribution in the tracts to which they have been found suitable. For the conduct of the trial plots, the cultivator places a portion of his land at the disposal of the department. The trials are conducted by the Agricultural Demonstrators on the lines and plans laid down by the Crop Specialists. The seed required for sowing is issued free and the cost of any cultural operations such as roguing and strip harvesting, etc., as would not ordinarily be done by the cultivator is met by Government. The produce is purchased by the Department if necessary or handed over to the cultivator.

There were in all 1,223 trial plots in the province during the year under report as against 1,414 plots of last year (15 months). There were in addition 536 observation plots in the II Circle for noting the behaviour of the new strains. The results of these trial plots have been dealt with in the research portion of the report under different crops.

V.—DEMONSTRATION.

24. The demonstrator is in direct charge of propaganda and demonstration work in each taluk. He takes up work in 6 to 8 central villages with a group of 4 or 5 small villages attached to each central village. Thus about 30 to 40 villages in each taluk receive his attention. If there is call from other villages he also visits them. He tours in these villages systematically and carries out a programme of work drawn up for the taluk. He studies local agricultural practices and demonstrates improvements in ryots' land on various crops grown in the locality. In addition to crop improvement, he also takes up questions of general importance such as proper preservation of cattle manure, preparing compost, control of insect pests and diseases, poultry and bee-keeping. In brief he acts as a guide to the farmer.

There are demonstrators in almost all the taluks of the Presidency and they arrange to conduct demonstration plots in villages to impress on the ryots the advantages of growing improved strains of crops and adopting improved methods of cultivation as compared with the local varieties or methods. The demonstrators have under them maistries and messengers to help them to carry out these practical demonstrations. The number of demonstration plots conducted during the year in the Presidency was 8,988 against 8,740 in the previous year.

The demonstrators have each a depot at their headquarters where seeds, implements and other agricultural requisites are stocked for sale and ryots visit these depots to get their requirements and seek advice on all agricultural matters.

25. *Demonstration maistries' scheme—Vizagapatam.*—Reference was made in previous years reports to a scheme of intensive propaganda in nine taluks of Vizagapatam district by a special staff of demonstration maistries. This is the fifth year of the working of the scheme.

The 72 demonstration maistries did their propaganda for ten months in 360 villages on improvements such as introduction of improved varieties of paddy, sugarcane, groundnut and millets—introduction of improved methods of cultivation, proper preservation of farm yard manure, composting all kinds of vegetable refuse, demonstration of improved implements, improved methods of jaggery-making and construction of improved furnaces. From May 1940, three maistries from each taluk were retrenched and the remaining 45 men continued their work.

In spite of unfavourable seasonal conditions there was considerable progress in the extent of improvements effected. The percentage of improved varieties of paddy to the total area under the crop rose from 28 in 1938–39 to 40 in 1939–40. There was an increase of about 17,000 acres in the application of green manure to paddy over last year. There was a rapid progress in the cultivation of superior varieties of sugarcane, the area under these varieties rising from 28 to 95 per cent of the total area under cane. Thick sowing of groundnut which gives higher yield increased from 26 per cent to 51 per cent. The introduction of new strains of groundnut A.H. 25 and A.H. 45 is gaining ground. There has been an increase in the area under plantain grown on improved lines and the area under the crop rose from 1,082 acres to 1,736 acres during the year under report.

The number of jaggery-making demonstrations conducted during the year rose from 588 to 4,162 and the improved furnaces constructed from 426 to 1,616.

There has been a steady progress in the better preservation of cattle manure, conservation of urine by dry earth and litter byres and composting vegetable refuse as could be seen from the statement below :—

	1938–39.	1939–40.
Manure pits and heaps properly covered	39,402	62,876
Conservation of cattle urine by dry earth and litter ..	21,330	39,198
Composts making	2,532	9,313

Bee-keeping, an important cottage industry, also received attention, the number of hives maintained during the year being 149 as against 96 during 1938–39. Pests and diseases were tackled on an area of 2,364 against 342 acres during 1938–39.

On the whole the scheme has been definitely successful. It is inevitable that with a scheme embracing a large number of items success in some directions should be greater than in others. In some directions the scheme has been spectacularly successful, in particular the increase in the area under improved varieties of sugarcane. Such varieties, of course need 'high' cultivation and apart from direct returns the education of the ryot in cultural practices and the use of manures will have lasting results.

Items of propaganda.

(1) Crops.

26. (1) *Paddy.*—The normal acreage under this crop is about 10·2 million acres in the Presidency and it occupies nearly 27 per cent of the total area cropped annually. It is cultivated in almost

all the districts in the Presidency under a wide range of climatic and soil conditions. Propaganda tending to the improvement of this crop consists in extending the area under superior varieties, thin sowing of nursery and economic planting, adequate manuring and proper preparation of the land.

(a) Distribution of superior strains of seed.—Paddy Breeding stations at Coimbatore, Maruteru, Aduturai and Pattambi have produced about 80 new strains suited to different tracts giving higher yield of 10 to 25 per cent over the ryots' bulk seed and some of them are also of superior quality. Seed of these strains are being distributed among ryots in different tracts. The spread of these varies from tract to tract but they have spread with marked success in the delta tracts of Godavari, Kistna and Cauvery. Most of the strains are intended to particular localities but some of them especially G.E.B. 24, Coimbatore 2 and Aduturai 3 have a wider range of spread and are being cultivated in many districts. Year by year the spread of improved strains is gradually progressing. It is estimated that during the year under report the area under this improvement extended over 2,026,250 acres against 1,704,399 acres in the previous year, and 29,000 acres in 1921. In certain districts for which there are larger number of suitable strains and where seed distribution work was started earlier, greater progress has been achieved especially in Tanjore, Madura, Kistna, Bellary and Guntur districts, the percentage of area under improved strains to the normal area being 52·4, 51·2, 43·7, 31·87 and 31·5, respectively. Taking the Presidency as a whole the improved strains have spread to about 20 per cent of the normal area under paddy.

Pattambi station which is to serve the needs of the West Coast is the youngest among the Paddy Breeding stations and the percentage of area occupied by new strains is rather low. In recent years 12 strains have gone out of this station suited to Malabar and South Kanara and they are just beginning to spread. Rapid development is expected in the course of next three or four years.

To evolve strains suited to Nellore and Tinnevelly tracts two sub-stations were started in 1936 at Buchireddipalaiyam and Ambasamudram. It takes nearly six to seven years to give out new strains from a station and it will take another 3 or 4 years to have new strains for these tracts.

The next item of propaganda—raising of healthy seedlings and economic transplanting—is being carried out in all paddy growing tracts in the Presidency. It has been the practice with the ryots to use a heavy seed rate of more than 100 lb. of grain in a thickly sown nursery to transplant an acre. Such thick sowing resulted in the production of thin and weak seedlings which had to be planted in bunches. The department demonstrates to the ryots that about 20 to 25 lb. of seed sown in a properly manured nursery area of 7 to 8 cents of land would give healthy seedlings to

transplant an acre economically. This improvement besides giving good harvest, results in a saving of seed to the value of 2 to 3 rupees per acre.

Although the ryots recognize the importance of raising good seedlings, they are apt to sow their nursery thickly unless they are persuaded to reduce the seed-rate at the time of sowing their nursery. In the Tanjore delta where the seed-rate is high special efforts were made during the year to demonstrate this improvement by employing eight special maistries in Tanjore taluk. These maistries did intensive work in 97 villages and demonstrated the proper method of sowing nurseries with reduced seed-rates. About 1,072 acres were transplanted with thin sown seedlings.

In many parts of the Presidency ryots are reluctant to reduce the seed-rate when they use their own bulk seed, but readily agree to do so when better seed of improved strains are supplied to them. This is due to the poor quality of the ryots' bulk seed which has lost its purity and vitality. So the practice of reduction of seed-rate and economic transplanting will spread with the supply of good seed. It is estimated that during the year this improvement covered an area of 1,420,029 acres as against 1,327, 462 acres in the previous year the largest area being in the Circars amounting to 435,840 acres.

(*b*) *Manuring*.—As the quantity of cattle manure available with the ryot is inadequate for the extensive area under paddy which requires bulky organic manure in large quantities, propaganda is being carried out to extend the area under green manure crops. Kolingi, daincha, sunnhemp, pillipesara are some of the important green manure crops. Advice is being given regarding the suitability of these crops to different soil and cropping conditions followed in different parts of the Presidency—and seed supply is also made to a certain extent. Private enterprise has stepped in to sell green manure seeds in many districts which clearly indicates that the practice has taken a hold in places where conditions are favourable for growing green manure crops. Year after year the practice of green manuring is extending and demonstrations are being carried out in new tracts. The practice is being followed in all the districts in the Presidency to a greater or less extent. The Circars and the Southern districts are leading in adopting this improvement. In the West Coast the practice is of recent origin and slowly gaining ground. Green manuring is the cheapest method of manuring paddy lands. It is estimated that during the year 384,310 acres were sown with green manure crops against 288,184 acres in the previous year. The figures show that the improvement is rapidly spreading. In conjunction with green manure, bone-meal, bone super and ammonium sulphate were also recommended in suitable places but the price for rice has in recent years not encouraged the extensive use of these concentrates. Oil cakes are being used for manuring paddy to a limited extent in certain districts.

The use of small improved iron ploughs instead of country plough is also demonstrated for preparing land with a view to give good tilth and save labour. The prejudice of the ryot to use iron ploughs is slowly dying out and he has begun to appreciate their usefulness and the area worked with improved ploughs is increasing.

The sum total of all these improvements is an extra income of 10 to 15 rupees per acre on a modest estimate. A ryot who follows these improvements will get this extra income. It is only a question of time and continued propaganda of an intensive nature for these improvements to spread over the whole Presidency.

(2) *Cotton.*—Cotton is one of the most important of the industrial crops of South India. It occupies on an average about 2·2 million acres in the Presidency. The important varieties grown go by the trade names Westerns, Tinnevellies, Cambodia, Northerns, Cocanadas, Nadam and Uppam.

Westerns cotton occupied 35 per cent of the total area cultivated, Tinnevellies 32 per cent, Cambodia 17 per cent, white and red Northerns 9 per cent, Cocanadas, Nadam and Uppam 7 per cent. Research work especially on the evolution of improved strains suited to different localities is in progress at Coimbatore, Koilpatti, Hagari, Nandyal and Guntur Research Stations. Superior strains released from these Research Stations are spreading in different tracts.

(*a*) *Cambodia.*—This variety is being grown in several districts but extensively in Coimbatore, Salem, Madura and Ramnad districts and occupies an area of about 5·75 lakhs of acres in the Presidency. A superior strain Co. 2 evolved at Coimbatore Research Station was released for distribution in the year 1928 and it has spread to an area of about 2·50 lakhs of acres. It has been found to benefit the cultivator to the extent of Rs. 15 per acre on account of its higher yield excluding the premium got for its superior quality. On this basis it may be reckned that its introduction is giving annually about 37 lakhs of additional income to cultivators. Last year on account of adverse seasonal conditions especially in Coimbatore district, the area sown with improved strains in the Presidency went down to 216,282 acres whereas it has risen to 247,863 acres during the year under report.

A new strain 920 which is hardier and giving higher yield but a bit shorter in lint length than Co. 2 was released in 1935 and this strain is replacing Co. 2 in Coimbatore to a certain extent. In 1938 two more strains—X 3915 and X 4383—crosses between Co. 2 and South African cottons were released for distribution. They are found to thrive well when sown in Masipattam (February-March) and suited to Ramnad district conditions. Their earliness and better quality combined with higher yield are points in their favour. Their lint fetches a higher premium of about Rs. 20 per

candy over that of Co. 2 in the market. There is very great demand for the seed of these strains and 829 acres were put under seed farm to meet the increased demand and the crop is expected to give more than 2,500 bags of seed sufficient to sow about 10 to 12 thousand acres under Masipattam Cambodia in Sattur, Shankarankoil and Srivilliputtur taluks. Experiments conducted on the Cotton Breeding Station at Coimbatore proved that September sown Cambodia gives an increased yield of 34 per cent over that sown in October which is the usual time of sowing in the district. This finding has worked a change in cropping around Coimbatore and farmers who have adequate water-supply especially in places having electric power have shifted their sowings to September and are sowing the seeds along the ridges to economise water.

(b) *Karunganni cotton.*—This is the important dry cotton grown in districts of Madura, Ramnad, Tinnevelly and parts of Coimbatore. It goes by the trade name Tinnies or Tinnevellies. Work on evolution of better strains is being carried on at Koilpatti and Coimbatore Research Stations. C.7, K.1 and K.P.T. 1 are the important strains giving higher profit and they are being distributed among the cultivators according to conditions prevailing in different localities. These strains are superior in lint quality and ginning percentage. Among these strains K.1 was leading and 203,400 acres were sown with these strains of which more than half was under K.1.

(c) *Westerns cotton.*—This cotton occupies the largest area in the Presidency and is grown in Bellary, Anantapur, parts of Cuddapah and Kurnool districts as a dry crop. H.1, a strain evolved at Hagari Research Station giving 10 per cent higher yield is spreading in this tract and 257,712 acres were under this strain during the year against 248,954 and 222,843 acres in the two previous years. The lint quality and ginning percentage of this strain is also better than the local and in a normal year it gives on an average about Rs. 2½ extra profit per acre.

(d) *Northerns cotton.*—This cotton is grown mainly in the Nandyal tract of the Kurnol district. N. 14, a strain possessing high lint quality evolved at Nandyal Agricultural Research Station is being distributed in this tract and covered an area of 15,353 acres during the year as against 10,160 and 4,368 acres in the two previous years. N. 14 lint fetched a premium of Rs. 20 per candy of 500 lb. over the local bought by Messrs. Binny and Co.

(3) *Millets.*—The principal millets grown in South India are sorghum (jonna or cholam), spiked millet (cumbu or sajja), ragi and Italian millet (korra or tenai). They are so very sensitive to soil and climate factors that there exist innumerable varieties and types in each of them. Different tracts have their own special varieties. They are cultivated in areas of scanty and precarious rainfall. Breeding work on millets is in progress at Coimbatore, Nandyal, Hagari, Guntur, Anakapalle, Palur and Koilpatti Agricultural Research Stations to evolve new strains

suited to these tracts. Already several superior strains giving about 10 per cent higher yield have been released and they are spreading in different tracts. The statement below gives details of these strains and their distribution :—

Name of the millet.	Strains under distribution.		Districts where they are spreading.	Estimated area under the strains.
				ACRES.
Cholam ..	Periamanjal rainfed ..	A.S. 29	Coimbatore, Salem ..	
		A.S. 1093 ..	Trichinopoly, North Arcot, South Arcot, Chingleput and Chittoor districts.	
	Irrigated	A.S. 1575 ..	Coimbatore, Trichinopoly.	150,703
		A.S. 2095 ..	Madura, Tinnevelly ..	
	Rainfed	T. 1, T. 12, M. 47-3.	Bellary and Anantapur districts.	
		T. 6, N. 23/3, N. 29/68.	Kurnool and Cuddapah districts.	
		J. 75	Guntur	
Ragi ..	E.C. 593 (120 days) ..		Vizagapatam, Chittoor, North Arcot, Salem, Coimbatore, Trichinopoly and Tinnevelly.	
	E.C. 3517			25,823
	E.C. 3735 (110 days) ..			
	E.C. 24	..	Tinnevelly	
	R. 42	..	Bellary	
Cumbu ..	P.T. 2229 (irrigated) ..	..	Coimbatore, North Arcot, Chingleput, Chittoor and Nellore.	
	P.T. 700 (African in origin).	..	Coimbatore and Salem.	8,323
	K.P.T. 5, 8, 105 ..	..	Ramnad and Tinnevelly.	
Korra ..	K. 23	..	Bellary	
	Nos. 132 and 140 ..	..	Kurnool	6,399
	K. 6, K. 9, K. 10 ..	..	Guntur	

(4) *Sugarcane.*—(*a*) Propaganda in connexion with the cultivation of this crop is carried out on the following lines—(1) Introduction of superior varieties, (2) Improvements in cultural and manurial methods, (3) Efficient milling of cane, (4) Introduction of improved furnaces for jaggery-making and (5) Preparation of better quality of jaggery. In earlier years, introduction of better varieties from Mauritius, Barbadoss, Fiji and Java in place of inferior indigenous varieties took place. These introduced varieties gradually replaced the indigenous varieties in many parts of the Presidency and gave increased yield. In recent years superior varieties produced at the Sugarcane Breeding Station at Coimbatore were found better than the earlier introduced foreign varieties and are rapidly replacing them. Sugar factories sprang up and the demand for superior varieties increased which gave sufficient stimulus to increase the area. At present Coimbatore varieties possessing high sugar content, higher tonnage, early and late maturing qualities are available for the benefit of the ryots as well as the factory owners. The earlier introduced varieties used to give 25 to 30 tons per acre whereas the new Coimbatore varieties give 30 to 40 tons and in some cases up to 60 tons per acre. The Coimbatore varieties have spread to all the districts in the Presidency and seed material for planting 1,369 acres was supplied during the year. The area under cane in the Presidency increased to 137,633 acres as against 98,262 acres in the previous year and the area under improved varieties went up to 86,891 acres as against 54,515 acres in the previous

year. Among the Coimbatore varieties Co. 419 is leading and popular in all the tracts. It is replacing some of the thin and medium Coimbatore varieties. Co. 421, an early maturing and drought resisting variety is also spreading.

(*b*) The method of preparing trenches with improved iron ploughs for planting and wider spacing between trenches to facilitate bullock hoeing are being demonstrated with a view to reduce manual labour charges.

(*c*) In many districts inefficient mills both wooden and iron were in use for milling canes resulting in loss of juice. Working of efficient iron mills tested by the department has been demonstrated and the wooden mills have almost disappeared. All facilities are being afforded to ryots in owning improved iron mills and during the year 237 mills were purchased by them. Demonstration of improved furnaces for jaggery preparation was continued with a view to economise the fuel bill and 2,909 furnaces were put up for ryots in different parts and preparation of better quality of jaggery was demonstrated in 4,646 places.

(5) *Groundnut.*—This crop ranks first among the commercial crops in the Presidency occupying about 4 million acres. Propaganda for the improvement of its cultivation consists in the introduction of superior strains, cultural methods and proper preparation of the produce to the market. Breeding work to get new strains is in progress at Tindivanam Research Station and two strains A.H. 25 and A.H. 32 are in distribution stage. A.H. 25, mass selected seed from among the spreading types and A.H. 32 from among the bunch types are good yielders. A.H. 45, a Mysore strain finds favour in certain tracts especially in parts of Guntur district. Of these, A.H. 25 in addition to giving an increased yield over the local is also reputed to withstand drought and suitable for tracts with poor or precarious rainfall. The distribution of seeds of these superior strains was started in recent years and they occupied an area of 15,061 acres during the year under report.

In Vizagapatam district the usual practice of sowing groundnut is in alternate furrows. The sowing of seed in every furrow to get increased yield was demonstrated and this improvement has covered an area of 80,538 acres.

The causes for the deterioration of the quality of South Indian groundnuts have been traced to the increase of free fatty acid content in the produce due to early harvest, wet storage and damping the pods before decortication. Propaganda has been continued to educate the ryots on these defects and to improve the quality of the produce.

(6) *Coconuts.*—Propaganda continued in giving advice in the matter of selection of seed-nuts and seedlings, proper method of planting, manuring and inter-cultivation of coconut gardens. The demand for selected seed-nuts and seedlings is increasing

and the year's demand was met from the stock available at the Coconut Research Stations in the West Coast and 1,687 seedlings and 3,993 seed-nuts were supplied.

(7) *Tobacco.*—The cultivation of cigarette-tobacco is pursued with interest in Guntur, Kistna and Godavari districts in an area of 101,665 acres. There was great demand for the seed of the superior strain, H.S. 9, and special arrangements were made to produce the seed and about 600 lb. were supplied. All possible assistance was rendered to ryots in raising proper nurseries and protecting the crop from fungus diseases and insect pests.

Investigations carried on with oil from seed of Virginia tobacco (large quantities of which are run to waste from so vast an area as noted above) have shown that it could be used as a semi-drying oil. The percentage of extraction ranged from 25 to 30. The tobacco seed cake is on a par with castor cake in its manurial value, with 5 per cent nitrogen and 2·5 per cent $P_2 0_5$.

There is awakening among ryots to cultivate cigarette-tobacco in other districts such as Nellore, Bellary and South Arcot. A mirasdar in Cuddalore taluk has grown it in an area of 15 acres and has constructed flue-curing barns.

A special variety of tobacco is grown in South Kanara district for preparing snuff. In recent years the produce is adulterated with sand and on account of this the reputation of the tobacco is going down. Propaganda was carried out among the growers and the petty merchants to prevent adulteration but the success achieved is not very appreciable.

(8) *Potatoes.*—Distribution of improved varieties of potatoes mostly Great Scot was continued in the Nilgiris, and 186,204 lb. of seed potato were distributed. In the whole of the district, superior varieties have spread and an area of 13,940 acres were under these varieties. Contour planting and proper manuring were advocated. Departmental help was given to ryots for grading the produce for seed purpose as well as for the market.

Introduction of superior varieties was taken up in other areas such as Hosur, Kodaikanal and the Shevaroys.

In the Kodaikanal area Great Scot is becoming popular. Seed material to the extent of 12,549 lb. was distributed and an area of 64 acres was planted. There is a possibility of this variety spreading and replacing the local variety in the tract.

(9) *Bengalgram.*—The season was unfavourable for this crop. Only 2,000 lb. of seed of strain No. 482 were distributed in Coimbatore district and the area sown was 200 acres.

(10) *Onions.*—The cultivation of Bellary variety is spreading in different parts of the Presidency especially in places adjoining big towns as there is demand for it as a vegetable.

About 653 lb. of seed were distributed in all the circles. The major portion of it to the extent of 475 lb. was sold in the IV Circle.

(2) Fodder.

27. Propaganda to persuade ryots to grow fodder crops was continued and the demand for seeds and slips of fodder crops was on the increase. The following seeds and grass slips were supplied to ryots during the year for raising fodder crops :—

Fodder cholam	10,371 lb.
Guinea grass slips	267,725
Kikiyu grass	1,250
Teosinte	86 lb.
Kolukattai grass	1,627 lb.
Lucerne	211 lb.
Maize	430 lb.
Pillipesara	5,548 lb.

Silage making was demonstrated and 11 silo pits in the I Circle and 10 in the III Circle were put up.

(3) Fruits.

28. As a result of intensive propaganda and a growing desire among the educated classes to include fruits in their dietary, the area under different kinds of fruits in the Presidency is on the increase. To meet the increased demand for planting material, fruit nurseries were started at Anakapalle, Guntur, Kodur and Taliparamba and the last two stations have already started the sale of such materials. In addition to this, supplies were arranged from reliable nurserymen in different circles. Methods of planting, manuring, irrigation, pruning and dealing with pests and diseases were explained and demonstrated. To disseminate such knowledge among ryots, 13 upper subordinates and 4 maistries were trained at the Fruit Research Station, Kodur and sent to different parts of the Presidency. Assistance was rendered to fruit growers in grading and marketing their produce. The fruit plants supplied through the departmental agency were as follows :—

Mangoes	32,765
Citrus (limes and oranges)	27,050
Pineapple	22,992
Sapota	581
Grape vine cuttings	315
Plantain suckers	3,108
Cashewnut	5,626
Guavas	52
Jack	81
Pomegranate	156
Others	5,274

(4) Agricultural implements and machinery.

29. Demonstrations were conducted on a large scale with improved ploughs and other implements. The ryots who have used the new implements like improved ploughs, buck scrapers, bund formers, ridge ploughs, mechanical seed drills, roll easy mhote wheels, etc., appreciate them. Poor ryots purchased them with the help of Takkavi loans. The light iron ploughs like Cooper 11, Cooper 25 and heavier ones like Cooper 26 and Kirloskar 14 found favour with the ryots, but the complaint against them was the high cost of spare parts. When the village black smith becomes fit to replace the easily worn out parts their popularity will increase. With a view to make cheaper ploughs available for the ryots, Messrs. P.S.G. & Sons of Coimbatore put on the market two ploughs Nos. 16-A and 16-B slightly lower in price, than similar ploughs of other makes.

The large number of spare parts sold through the Agricultural Demonstrators during the year is an indication that the improved ploughs supplied to ryots are being used regularly and not kept idle. Sales of spares were steady during the last three years.

The following statement shows the number of demonstrations conducted with improved ploughs and other implements during the year :—

	Number of demonstrations.
Improved ploughs	17,177
Guntakas	1,913
Pruning tools and other horticultural implements	4,413
Roll easy mhote wheels	2,320
Bullock rahat	46
Triangular harrows	83
Bund formers	817
Planet Junior hoe	401
Buck scraper	455
Chaff cutters	230
Sprayers	2,101
Tutmeric polisher	175
Digging forks	207
Dusting machines	40
Ridge ploughs	204
Wetland puddler and Nolla and levelling boards	135
Basin lister	9
Seed drill	166
Archemedian Screw	75
Bullock harness	20
Green manure trampler	111
Cotton gin	6
Pitting crow bar	30
P.S G. rice sheller	3
Sugarcane mills	365
Power crusher	16

As a result of these demonstrations 3,526 ploughs were sold departmentally and 2,313 were sold by private firms against a total of 6,608 sold last year. Details of other sales during the year are given below :—

	1939-40.
Spare parts for ploughs	5,239
Guntakas	44
Roll easy mhote wheels	631
Chaff cutters	12
Seed drills	8
Bund forming implements	45
Mhote buckets	110
Planet junior hoe and other hoes and harrows.	83
Buck scraper	14
Sprayers and dusters	25
Sugarcane mills	49
Jaggery pans	200
Archemedian screws	3
Pruning implements	52
Turmeric polisher	4
Persian wheel water lifts	38
Digging forks and garden forks	66
Circular mhote	2
Other implements	65

(5) Apiculture.

30. The progress in research on bee-keeping has been dealt with in the earlier part of this report. Educated people are taking increased interest in apiculture and numerous enquiries for advice and help were received from different parts of the Presidency. The demand for literature on the subject as well as for practical help in hiving colonies and supply of apiary appliances such as hives and honey extractors is on the increase.

In favourable localities such as Pittapur in East Godavari and Kalrodepalli in Chittoor district, Central Apiary Schemes are at work for developing apiculture, the former having about 250 bee colonies and the latter 215 under its control.

In Tinnevelly and Trichinopoly districts special bee messengers were employed and large number of hives are maintained in these districts. In recent years, throughout the Presidency a wide awakening has been created for developing apiculture and the number of hives maintained are increasing year after year. The following statement gives an idea of the present position of the development :—

Bee-hives maintained	5,019
Demonstrations of better methods of extracting honey	853
Bee colonies hived	2,541
Bee-hives supplied to parties	1,217
Honey extractors supplied	46

(6) Seed supply.

31. The demand for seeds of superior strains of crops is in the increase. This demand is met in two ways (1) direct supply from the stock produced in different research stations and seed farms run by the department, (2) indirect supply from ryot to ryot.

When the stock in the various departmental depots is exhausted ryots are directed to other cultivators who have been cultivating these superior strains and keep a portion of the produce for sale to other ryots.

In regard to green manure seeds, the department stocks a certain quantity in different depots and in some tracts local merchants keep a large stock for sale to ryots.

In certain districts co-operative societies are doing seed multiplication work to a limited extent.

The following quantities of seed were supplied to ryots during the year through departmental agency :—

	TONS.
Paddy	2,973
Cotton	277·4
Millets	30
Oil-seeds	29
Green manure	103·6
	SETTS.
Sugarcane	33,311,898

(7) Loans.

32. During the year under report, Takkavi loans were granted to ryots to the extent of Rs. 14,796 for the purchase of the agricultural implements mentioned below, as against Rs. 24,928 in the previous year :—

Agricultural implements.	Number.
Ploughs	1,563
Water lifts	6
Mhote wheels	365
Cultivators, guntakas, dantulus, drill sets, bund formers	81
Sprayers	9
Spare parts of ploughs	549
Sugarcane crushers	1
Miscellaneous implements such as chaff cutter, secateur, digging fork, hand gin, etc. ..	48

In addition to the loans sanctioned by this department, the Revenue department sanctioned loans to the extent of Rs. 2,220.

(8) Manures.

33. *Farm yard manure.*—Proper collection and preservation of cattle manure (both urine and dung) formed one of the main items of propaganda work. In order to achieve this object, proper covering of manure heaps, storing manure in pits, collecting urine by dry earth system and stalling animals in loose box cattle sheds were demonstrated. By adopting these methods, the quality and the quantity of the manure collected has improved. As a result of this propaganda, 34,463 manure heaps and pits were kept on improved lines and 48,073 dry earth and loose box sheds were put up. There is considerable progress in this line of work compared with previous years.

Composting of farm and habitation waste material was demonstrated in 13,070 places and ryots adopt this system of collecting manure.

In certain Municipal and Panchayat areas composting of night soil and organic rubbish was demonstrated and the compost so prepared found a ready sale for manurial purpose. More municipalities will be persuaded to adopt this system.

Green manuring.—This is the cheapest method of manuring and the practice is extending year after year especially in paddy growing tracts. It adds considerable quantity of humus and improves the physical texture of the soil in addition to the supply of plant food. The important green manure crops grown in the Presidency are :—Daincha, kolingi (wild indigo), sunnhemp, indigo and pillipesara according to soil conditions and cropping practices. In certain localities, green manure crops are also grown in coconut and fruit gardens.

The total quantity of green manure seeds sold by the Department during the year was 232,285 lb. and a fairly large quantity was purchased by ryots from local dealers. The total area that received green manuring is estimated to be 384,310 acres as against 288,184 acres in the previous year.

Concentrated manures.—Oil-cakes, ammonium sulphate, bone-meal, super phosphate, etc., are in use especially to money crops such as sugarcane. Propaganda is being carried on for the extensive use of oil-cakes for manurial purpose.

(9) Pests and diseases of crops.

34. The major pests and diseases such as stem-weevil and pink boll worm of cotton, hairy caterpillar pest of groundnut and dry crops and bud-rot disease of palmyra and coconut were controlled by enforcing the Pest Act in places where they assumed a serious form. The details of the action taken under the Pest Act are given in Section VI of this report under Legislation.

To take prompt action against pests and diseases, specially trained subordinates 13 in number are stationed in different parts of the Presidency. They received about 5,000 calls from ryots and rendered timely assistance to them in dealing with pests such as caseworm and Spodoptera on paddy, sugarcane borer, coconut beetle and caterpillar, mango hoppers, thrips on chillies, jasmine bug, grass-hopper, fruit borers and sucking moths, aphids on citrus, and diseases like mildew on grapes and dieback and gummosis on fruit trees.

(10) Agricultural marketing.

35. *Marketing surveys.*—During the year, the final market survey reports on lac and jute were completed and forwarded to the Agricultural Marketing Adviser to the Government of India, Delhi and the Government. An advance copy of the 'Supply and Demand' and 'Utilization' Chapters on the marketing survey of sugar in the Presidency was sent to the Agricultural Marketing Adviser to the Government of India, Delhi. After the publication of the report of the All-India marketing survey of tobacco in November 1938, the provincial report which was completed in 1936 was revised and the statistics brought up to date in November 1939. The surveys on maize, bengalgram, cashewnuts, sugars, fish and prawns, were continued and the reports are under compilation. Up-to-date statistics and supplementary information were also furnished to the Agricultural Marketing Adviser to the Government of India, Delhi, on the several survey reports already submitted and which are being compiled by the Central Marketing Staff. A special investigation of the trade in lacquer toys at Etikopaka (Vizagapatam district) was made and a report sent to the Government.

Development work.—In addition to the survey work, considerable amount of development work was carried out during the year. The appointment of four Agricultural Marketing Assistants in May 1939 made it possible to take up more intensive development work and considerable progress was made during the year under report. The services of the Marketing Staff are now being more and more requisitioned by the public, co-operative societies, the trade and all other agencies interested in marketing. A brief abstract of the development work done in the year is given below :—

(i) *Grading of agricultural commodities.*—One of the main defects of the present methods of marketing agricultural commodities is the absence of any standard type or quality of produce. Consequently there is no reliable basis for price quotations. Although grading of commodities is beneficial to the growers, merchants and consumers in various ways, systematic grading has not been so far adopted in this Presidency. If the Agricultural Produce (Grading and Marking) Act enacted by the Government of India in 1937 is properly utilized, it will have far-reaching effects in the course of time in the economic development of the

country. For work connected with the fixation of grade standards, 64 samples of rice, paddy, ghee, coffee and groundnuts were collected and sent to the respective officers and commercial firms; the total number of samples sent so far including those of the previous years is 1,682. In order to familiarise the merchants, producers and consumers regarding grades, quality characteristics of the commodities and the benefits of sale and purchase on well-defined grades, a few experimental grading stations were started in 1938–39 for eggs at Ongole, rice at Kuttalam and Nellore, Sathgudi oranges at Madras and mangoes at Chittoor. As the results of these experiments were encouraging, this line of work was extended during the year to include the following commodities :—

Commodity.	Types or varieties.
Rice	White Sirumani, Red Sirumani, Korangu Samba, Nellore Samba, Kusuma, Atragada, Delhi Bhogam, G.E.B. 24.
Oranges	Sathgudi, Wynaad (Coorg).
Mangoes	Bangalora, Neelam, Malgoa, Peter, Mundappa, Khadar, Rumani, Banganapalle.
Pine-apples	Kew, Mauritius.
Eggs	Hen, duck.
Potatoes	....
Cane jaggery	....
Tobacco	Virginia, Natu.

In fixing grade standards, the special quality characteristics of each commodity are taken into consideration. Rice varieties have three grades each, Special, A and B, and these grades are based on the degree to which blemishes like dirt, broken grains, foreign matter and the presence of weevilled, damaged and discoloured grains. Oranges, mangoes and potatoes are graded mainly according to the size. Cane jaggery is graded according to colour and texture. Hen eggs are graded into six grades—Extra special, Special, A, B, C and D—minimum weight of the eggs under each grade being 2 oz., 1-7/8 oz., $1\frac{3}{4}$ oz., $1\frac{1}{2}$ oz., $1\frac{1}{4}$ oz. and below $1\frac{1}{4}$ oz. respectively.

Grade standards have also been fixed for hides and skins, lime juice, cordial and squash, edible oils and edible groundnuts. Owing to various difficulties in fixing suitable standards for ghee in this Presidency, it was not possible to start ghee grading stations.

A number of co-operative associations and individual merchants in various parts of the Presidency have been authorized to grade their produce and mark the packages with 'Agmark' seal and label.

The progress being made in grading is shown by the fact that while the total value of produce graded up to the 30th June 1939 was only Rs. 1,16,347, in the year under report the total value of graded produce was Rs. 6,39,315. Of this total Nellore rice contributed Rs. 3,61,061, or more than half, while rice graded at Kuttalam accounted for Rs. 1,44,018. Oranges graded in Madras were valued at Rs. 36,580 and potatoes graded at Mettupalaiyam at Rs. 26,993.

(ii) *Supply of market intelligence.*—About 150 major enquiries from producers, merchants, co-operative societies, traders' associations and departments of Government were answered during the year. Registers of merchants and producers were maintained. Weekly reports of arrivals, sales, stocks, prices, etc., at the cattle market at Tiruvottiyur were published in the Madras daily papers.

No one is more conscious than the department of the wide gap between the demand for market intelligence and the supply but this is the most difficult service of all to organize. Such trade organizations as Chambers of Commerce complain of the difficulty of getting reliable figures from those engaged in various trades, especially of such things as stocks held, and traders are not more communicative to officers of Government than they are to their own trade bodies.

(iii) *Negotiations with railway companies for the reduction of freight and the provision of facilities.*—At the first stage of commercial development the marketing staff has to conduct negotiations on behalf of producers which the producers if better organized could conduct themselves. They were instrumental in getting rates reduced, sometimes to half, on the following commodities over various routes :—

Plantains, pine-apples, limes and lemons in bags, potatoes, ice (for consignments of fish), improved egg containers (full and empty), rice and paddy and cumblies (blankets of cottage manufacture).

An insulated van for fish was also provided by the South Indian Railway at the instance of the Marketing Section.

(iv) *Formation of marketing societies and assistance to societies already established.*—It is an important part of the duties of the marketing staff to encourage the formation of co-operative societies for the sale of agricultural products. Such work has, of course, to be done in close co-operation with the officers of the Co-operative Department. With their assistance the following societies were formed during the year :—

(1) A Sugarcane Growers' Society at Kattuputhur in Trichinopoly district;

(2) A Fruit Growers' Society at Tenali (Guntur district).

Vigorous endeavours were made to persuade paddy producers in Tanjore to improve their marketing organizations which it is hoped will shortly have the desired result.

Assistance and advice were given to a number of existing societies.

(11) Exhibitions and shows.

36. Agricultural exhibitions and shows were held as usual during fairs and festivals, conferences, health week celebrations, jamabandi camps and the like whenever there were occasions of ryots' gathering in large numbers. On all these occasions superior strains of crops, improved ploughs and implements were exhibited. Demonstrations on proper preservation of cattle manure, preparation of jaggery on improved methods, maintenance of bee hives, and proper handling of improved implements were conducted. The number of exhibitions and shows held during the year were 429 as against 379 in the previous year. Of these the important were :—

(1) The Annual Vizagapatam District Exhibition at Tekkali.
(2) The Industrial and Agricultural Exhibition at Vuyyur.
(3) The All-India Khadi and Swadeshi Exhibition at Madras.
(4) The District Industrial and Agricultural Exhibition and Cattle Show, Nellore.
(5) The Rural Exhibition at Thrithala organized by the Thrithala Co-operative Organization, Malabar district:

These exhibitions served a very useful purpose in educating the ryots on the several activities of the department.

During the exhibitions, fairs and conferences and while on tours the Agricultural Demonstrators delivered 119 lectures with the aid of lanterns and 1,971 ordinary lectures on agricultural and allied subjects.

Work through other agencies.

(1) Co-operation.

37. Officers of this department worked in close touch with the officers of the Co-operative department and took advantage of the co-operative organizations in the province for distributing seeds, implements, manures, granting crop loans and co-operative marketing of ryots' produce.

In the I Circle, the Sugarcane Growers' Co-operative Society at Bobbili stocked manures and implements for sale to members and also gave improved implements on hire. The society maintains a seed farm for the multiplication and the distribution of seed material of superior varieties of sugarcane. The Co-operative Society at Pithapuram rendered help to its members in the production and sale of honey.

In the II Circle 12 co-operative societies were under the guidance of the Agricultural Demonstrators of which 3 are loan societies at Rajampet, Proddatur and Tiruttani, 2 are co-operative unions at Uttiramerur and Hospet and one is an Agricultural Improvement Co-operative Society at Chennur, and the rest are ordinary primary co-operative societies. These societies distributed 20 ploughs, 2 puddlers, 159 bags of fertilizers, 2 bee hives and paddy and green manure seeds worth Rs. 182. The Hospet Sugarcane Growers' Co-operative Union advanced Rs. 2,250 to its members for the purchase of seeds and manures. This society worked manurial trial plots in the holdings of members and hired out implements such as Madras ridger to its members. It did propaganda work for extending the cultivation of Co. 419 sugarcane and the use of artificial manures in conjunction with the bulky organic manures.

In the III Circle several loan and sale societies were helped to stock implements, seeds and manures for sale. The Lalgudi Sivagnanam Co-operative Society maintains a Kangayam breeding bull. It effected sales of 8,000 lb. of paddy seed, 60·36 tons of organic manure and 748·08 tons of Chemical manure. The co-operative demonstration farm at Kumbakonam was not very active except for distributing paddy and green manure seeds to a limited quantity.

In the IV Circle the Co-operative Sale Society at Tiruppur continued the work of production and distribution of Co. 2 Cambodia cotton seed. During the year it produced 268 tons of seed sufficient to sow about 25,000 acres. This society is doing useful work. The Thrithala and Vadavannor Co-operative Societies in Malabar did some paddy seed distribution work. The Mahali Prevention Co-operative Society in South Kanara supplied sprayers and spraying materials to arecanut garden owners to control Mahali disease.

(2) Agricultural associations.

Efforts were made to organize agricultural associations to carry out agricultural improvements and other activities connected with the rural uplift work. These associations are in their initial stage and much progress was not achieved except in the case of a few.

In the I Circle there were 120 such associations. The Vizagapatam District Agricultural Association conducted District Agricultural Exhibition at Tekkali and contributed financial help towards the award of prizes.

In the II Circle there were 417 Village Agricultural Advisory Committees and held 1,258 meetings during the year and discussed matters pertaining to rural improvement especially improvements suggested by the Agricultural department.

In the III Circle there were 58 Village Associations with two District Associations, one at Trichinopoly and the other at Tanjore. The Trichinopoly District Agricultural Association publishes a monthly journal.

In the IV Circle there were 16 Agricultural Improvement Associations of which the one at Unaj, in North Arcot district did useful work during the year. This association was in its third year of working. As a result of continued progress about 80 per cent of the cultivated area in the village has been brought under new strains of paddy, sugarcane and green manure. The association distributed 2,624 lb. of Kolingi seed and 3½ lakhs of sugarcane setts and advanced loans up to the extent of Rs. 600 for cultivation expenses.

(3) Koya Uplift Scheme.

The scheme sanctioned by Government to improve the economic condition of the Koyas in the East Godavari Agency continued for the second year in the villages of Ramaraopet, Arlagudem and Golagatta.

Improved varieties of crops suitable to the tract were introduced. Five hundred and forty pounds of paddy, 140 lb. of jonna, 25 lb. of ragi and 533 lb. of pulses were advanced to the Koya ryots at sowing time and recovered at the time of harvest. This kind of advance at sowing time was very much appreciated by them since they had to return to Government only a quantity equal to that actually advanced while under the local "Sarinaku" system they had to return double the quantity borrowed from the merchants.

The following improved methods of agriculture were introduced :—

(1) Reduction of seed rate for paddy nurseries.

(2) Transplanting of paddy seedlings instead of sowing broadcast.

(3) Growing of green manure crops in paddy lands.

The introduction of improved varieties of paddy and the application of green manure gave increased yields. In swampy areas where no crop was grown before, Harisankar paddy was introduced. The departmental jonna strain, T. 6, distributed in all the three villages gave an increased yield of 20 per cent over the local. Sowing of jonna in lines with gorru was demonstrated. About 75 acres were sown with jonna treated with sulphur to check smut disease. The growing of pulses like greengram and blackgram after an early crop of paddy was not known in the tract and the introduction of these crops brought an additional profit of Rs. 15 to Rs. 20 per acre.

Methods of storing cattle manure in pits and the manufacture of compost from green leaf, weeds and other organic waste materials were demonstrated.

To meet the fodder scarcity during the summer months, attempts were made to increase the area under fodder jonna. Demonstration of silage making during the months of September and October when green grass was available in plenty was undertaken in all the three villages with a view to safeguard the shortage of fodder during the summer months of April and May.

The three villages have been supplied with two pairs of cattle and two mould board ploughs each and good use has been made of them. The bulls are reported to be maintained in good condition.

VI.—Legislation.

38. *Cotton Ginning and Pressing Factories Act (Act XII of* 1925).—Inspection of about 400 cotton ginning and cotton pressing factories under the Act were conducted both by the Inspectors of Factories and the Assistant Directors of Agriculture. There were no prosecutions in the year.

Two new pressing factories in Bellary district were opened during the year, bringing the total number of factories actually working in the Presidency, to 63.

39. *Cotton Transport Act*, 1923 (*Act III of* 1923)—(i) *Single licences by rail.*—Thirty-seven licences were issued during the cotton year 1st February 1939 to 31st January 1940 along with a certified copy in each case. Ten of these issued during the period from 1st February to 30th June 1939 were included in the last year's report. Of the remaining 27, one related to the import of cotton lint by a spinning mill at Madura, two to the import of cotton waste into Tiruppur from Bangalore for pressing and export to the United Kingdom, and the rest to the import of cotton waste mostly into the Southerns protected area for purposes of making mattresses and pillows. In addition, 25 single licences with a certified copy for each were issued during the period from 1st February 1940 to 30th June 1940. Of these, one related to the import of cotton lint into Guntakal from Guntur by Messrs. Volkart Bros., for a cleaning trial with a cotton opener installed in their pressing factory at Guntakal, one to the import of cotton lint by a spinning mill at Madura and the other 23 to the import of cotton waste for making mattresses and pillows.

(ii) *Annual licences.*—Thirty-seven general licences with 837 certified copies were issued to the cottón mills mostly in the Coimbatore district in the 'Southerns' protected area for import of ginned cotton by rail during the cotton year 1939–40 (1st February 1929 to 31st January 1940) as against 34 licences with 667 certified copies issued during the corresponding period in

1938–39. Of the 837 certified copies, the mills utilized 670 certified copies as against 514 copies in the previous year, and returned the remaining 167 copies as unused.

In addition to the above, 34 general licences with 861 certified copies pertaining to the cotton year 1939–40 were issued to the cotton mills in the period from 1st February 1940 to 30th June 1940.

(iii) *Single licences by sea.*—One hundred and twenty-eight licences were issued during the year under report for the import by sea of 87,043 bales of ginned cotton into the Tuticorin port as against 156 licences for 100,474 bales issued during the previous year.

40. *The Madras Cotton Control Act (Act VII of* 1932).—The Act continued to be in force in the Coimbatore, Madura, Ramnad and Tinnevelly districts. While there was no offence under the Act in the Coimbatore district only stray plants of pulichai cotton were noticed in the Madura district (Tirumangalam taluk) and these were promptly removed. The cultivation of pulichai cotton in the Tinnevelly district, however, was on the increase and a special Agricultural Demonstrator was posted for detection work from 8th December 1939. The number of cases prosecuted was 240 and the total fine levied was Rs. 1,213. Sixty-nine cases were pending in courts at the close of the year.

41. *The Madras Commercial Crops Markets Act (Act* XX *of* 1933).—(i) The Tiruppur Cotton Market Committee constituted under the Act with the personnel of 12 members (elections held at the close of December 1938) continued to function for the fourth year. Steps have been taken by the committee to put up suitable godowns in the Holmes Market purchased for Rs. 60,000 from the Tiruppur Municipality. The question of extending the Act to the whole of Coimbatore district referred to in the last year's report was dropped. The desirability of opening other centres with independent market committees in the Coimbatore district is, however, being examined.

At Tiruppur, the Market Committee continued to do useful work for the fourth year in succession in spite of the fall in income as compared to the previous year. The publication of the daily market report is a regular feature; a Tamil translation of the market opinion is also published. The public in the main Cambodia tract are now aware of the facilities in prices, market yard, stocks, trend of market, etc., afforded by the Market Committee.

(ii) The South Arcot Groundnut Market Committee entered on its second year of working the Act from 1st April 1940. The number of members of the committee was reduced from 12 to 9 from that date and the personnel appointed by Government for one year. Six market yards were opened by the committee at Cuddalore, Tindivanam, Vriddhachalam, Ulundurpet, Tirukkoyilur

and Villupuram. This ensured to sellers the advantages of good prices, free and correct weighment, prompt payment and absence of illegal deductions.

(iii) The Guntur and Bezwada Tobacco Market Committee was split up into two from 1st April 1940 by having a separate market committee for Bezwada taluk, the Guntur Committee having jurisdiction over the Guntur district which was declared as a separate notified area. The Bezwada Tobacco Market Committee was constituted from 1st April 1940 with seven members all appointed by Government for one year and the Guntur Tobacco Market Committee was re-constituted from the same date with nine members all appointed for nine months from 1st April 1940. The by-laws of the Guntur Committee were adopted by the Bezwada Committee. Five market yards were declared open by the Guntur Tobacco Market Committee, viz., Chilakalurpet, Ongole, Mangalagiri, Guntur and Parchur. The yard in the municipal area at Bezwada fixed by the Guntur and Bezwada Market Committee last year not being suitable, the present Bezwada Market Committee is considering the question of selecting another suitable site for its yard in place of the existing one.

(iv) The Act was enforced in the municipal areas of Adoni and Nandyal in respect of cotton with effect from 1st October 1939. A market committee with 12 members for each of these two areas was appointed by Government for one year from that date. The services of an Agricultural Demonstrator were loaned to the Nandyal Cotton Market Committee during the year while another demonstrator has only recently been posted to the Adoni Cotton Market Committee. Market yards have not yet been opened by these committees; at Adoni, the committee proposes to purchase outright some area and has just applied to Government for a loan. It is too soon to judge the effect of the enforcement of this Act in the above areas.

42. *Pest Act—The Madras Agricultural Pests and Diseases Act*, 1919 (*III of* 1919) *as amended by Act VII of* 1925.—This Act continued to be in force during the year in the districts mentioned below for the eradication of the diseases and pests attacking Cambodia and Pachanadan cottons, groundnut and other dry crops, palmyra and coconut, and for the eradication of water hyacinth. The " Mosaic " or " Marble " disease of the cardamom crop was for the first time brought within the purview of the Act in the year under report.

(i) *Cotton.*—As in the previous year, " Stemweevil " (*Pempheres affinis*) and " pink boll-worm " (*Galechia gossypiella*) attacking Cambodia and Pachanadan cottons were declared insect pests under the Act in the districts of Coimbatore (except the Kollegal taluk), Trichinopoly and Madura (except certain villages in the Tirumangalam taluk) and the taluks of Omalur, Tiruchengode, Salem, Namakkal, Rasipuram and Attur of the Salem district. The eradication of the cotton plants before the prescribed

date was complete in the Salem district while in the Coimbatore district some time had to be allowed for the removal of the crop in certain villages of the Pollachi and Udamalpet taluks. In the Trichinopoly district, Kulittalai taluk was a little backward in removing the plants on the prescribed date, but by the third week of October the entire area had been cleared. The working of the Act may be said to have been satisfactory in the Madura district. The Mallapuram hills of the Tirumangalam taluk, reference to which was made in the last year's report, has since been exempted from the operations of the Act.

(ii) *Groundnut.*—For the purpose of controlling the red hairy caterpillar pest (*Amsacta albistriga*) attacking groundnut and other dry crops, the Act was in force in the following districts :—

Trichinopoly district—Musiri taluk and five firkas of Udayarpalayam taluk.

Tanjore district—Five firkas of Tanjore taluk and one firka of Pattukkottai taluk.

South Arcot district—(Whole).

Chingleput district—Chingleput, Tiruvallur, Sriperumbudur and Conjeeveram taluks.

Vizagapatam district—Tekkali taluk and the Chicacole taluk including the Narasannapeta sub-taluk.

North Arcot district—(Whole).

The usual campaign against the pest was conducted in all districts with the aid of special staff and with the co-operation of the ryots. The pest generally appeared only in a mild form and was brought under control. There was very little damage to crops.

(iii) *Water hyacinth.*—The Act was in force in respect of this weed in the districts of Chingleput, Madras City and Tanjore, and the Ramachandrapur, Amalapur and Cocanada taluks of the East Godavari district. Certain villages of the Ernad and Walluvanad taluks were also notified under the Act.

(iv) *Palmyra and coconut.*—Bud-rot disease of palms assumed a serious form in East and West Godavari districts. Simultaneously with the enforcement of the Act, special staffs of Revenue Inspectors and maistries and a Deputy Tahsildar for West Godavari district were appointed and over a lakh of trees were operated in the course of the year. Messrs. Parry & Co., who are connected with the sweet toddy industry in West Godavari district gave considerable assistance in the work of controlling the disease.

In Malabar district, the Act continued to be in force for the eradication and prevention of bud-rot, in the Walluvanad, Palghat and Ponnani taluks. With the assistance of a special staff of one Sub-Assistant in Mycology and three demonstration maistries, out of a total of 5,447 diseased trees all except 846 were operated.

Other areas in which the Act was enforced were certain villages in the Tenali and Repalle taluks of the Guntur district and in the Bezwada and Bandar taluks of the Kistna district.

(v) *Cardamom.*—With a view to prevent the introduction of the "Mosaic" or "Marble" disease of cardamom into the Nelliampathies area situated in the Palghat taluk of the Malabar district, Government issued notifications for the purpose of regulating the importation of the plant into that area. The notification will be in force up to 31st March 1942.

VII.—PUBLICATIONS.

43. The Villagers' Calendar was as usual published in English, Tamil, Telugu, Kannada and Malayalam. The transmission of agricultural knowledge to the public especially to the ryot population through the All-India Radio Agency at Madras and Trichinopoly was continued. The following publications were revised and issued during the year :—

Subject.	Languages in which published.	Price. RS. A. P.
	Books.	
The Villagers' Calendar ..	English, Tamil, Telugu, Kannada, and Malayalam.	0 1 0
	Leaflet Series.	
85 Bullock harness	Tamil and Telugu	Free.
86 The Improved Circular Mhote Water Lift.	Tamil and Malayalam ..	Do.
88 The Cultivation of Ginger on the West Coast.	English	Do.
19 School garden	Do.	Do.
5 Home-made malt food ..	Do.	Do.
4 The malting of cholam ..	Do.	Do.
47 Note on cashewnut	Do.	Do.
36 Bud-rot of Coconuts and palmyrahs.	Telugu	Do.
38 Water Hyacinth	Do.	Do.
23 The Hairy Caterpillar pest.	Kannada and Tamil	Do.
16 Note on trials of proprietary manure.	English and Tamil	Do.
17 How to improve the cultivation of Combodia in Salem district.	Tamil	Do.
18 Note on chemical analysis of potato varieties grown at the Agricultural Research Station, Nanjanad.	English, Tamil and Kannada.	Do.
15 Nadam cotton	Tamil	Do.
	Bulletins.	
37 Bee-keeping in South India.	English	1 0 0

Radio talks.

Subject.	Languages in which talk was given.
1 Millets as food	Tamil.
2 Minimizing waste in groundnut	Telugu.
3 Deeper furrows	English.
4 Hairy Caterpillar pest and its control measures.	English, Tamil and Telugu.
5 Necessity for reducing the seed-rate of paddy for sowing in nurseries.	Tamil.
6 Tillage	English, Tamil and Telugu.
7 Dietetics of Banana	Do.

VIII.—Statistics.

44. *Weekly Cotton Mill and Press returns.*—There were 53 cotton spinning mills working in the Presidency during the year. The weekly returns are on a voluntary basis and are furnished on stamped forms supplied by the department. Nevertheless, some mills were very unpunctual in the submission of the return and in some cases figures could not be had without repeated reminders. Returns from cotton presses, obligatory under the Cotton Ginning and Pressing Factories Act, and from the Customs authorities, were regular.

45. *Crop-cutting experiments.*—The three years' crop-cutting experiments laid down for the staple-food crops, paddy, cholam, cumbu and ragi and for sugarcane, were completed with the year 1939–40. The results are being tabulated and analysed by the Director of Industries and Commerce. The question as to what other crops should be taken up next for experiments is under examination.

IX.—Expenditure.

46. The receipts and expenditure for the financial year 1939–40 and the corresponding figures for the previous year are given below :—

	1938–39.	1939–40.
	RS.	RS.
Expenditure	20,62,316	19,80,748
Receipts	3,00,147	3,28,189
Net expenditure ...	17,62,169	16,52,559

The above figures include Rs. 1,25,649 under expenditure and Rs. 1,24,510 under receipts for 1938–39 and Rs. 1,21,995 under expenditure and Rs. 1,26,310 under receipts for 1939–40 on account of the schemes financed by the Indian Central Cotton

Committee and the Imperial Council of Agricultural Research. Excluding the expenditure on the schemes, the decrease in expenditure in 1939–40 as compared with that of 1938–39 is mainly due to retrenchment in staff and economy on account of war emergency. The slight increase in the receipts is due to the favourable season which facilitated seed distribution work on a larger scale than in the previous year and the sale of more implements to ryots.

X.—PROGRAMME OF WORK FOR 1940–41 (FASLI 1350).

A. *Chemistry.*—Analytical and advisory work will continue as usual.

Irrigation research.—The problems that were under study last year will be continued.

Research on soils.—In addition to the problems that were under study last year, reclamation of work on alkaline soils will be taken up.

Plant nutrition.—Permanent manurial experiments, effect of manuring of seed-bed on subsequent growth of paddy, and effect of manuring on quality in plantain and on crop quality in cereals.

Animal nutrition.—Protein requirements of work bullocks, mineral metabolism studies, biological value of cereals, pasture studies and studies in the quality of rice.

Microbiology.—Studies in Nitrogen fixation by Azoto-bacter inoculation and legume nodule studies and studies on the micro-biological population of black soil before and after irrigation.

Sugarcane and jaggery work.—Preparation of active carbon from waste materials, and studies on other uses of active carbon and cause of development of colour in jaggery.

Malting of cholam.—Clinical test on malt cholam, bio-chemical studies on the malt grains and foods, blending of malt foods, therapeutic malt foods, malting of paddy and other cereals, and varietal tests with cholam for malting purposes.

B. *Botany.*—Identification of plants, botanical survey to be made in parts of Coimbatore district, continuation of the varietal survey of the bananas and study of their cultivation practices in the district of Salem and in Travancore, classification of the banana varietal collections so far made at Coimbatore, identification of grasses and continuation of the study of the common indigenous grasses and fresh introductions.

C. *Crops—Cereals*—(1) *Millets.*—Comparative trials of high yielding strains of cholam, cumbu, ragi and korra for rainfed and irrigated conditions, studies in the inheritance of characters in Sorghum, improvement of the fodder value of cholam straw, selection of varieties suitable for malt making, varietal studies

and selection for yield in cholam and cumbu, striga resistance studies and yellow leaf resistance studies in cholam, and the evolution of a short duration economic strain in ragi.

(2) *Paddy.*—Improvement of local varieties in Coimbatore, Maruteru, Aduturai and Pattambi, continuation of seasonal trials, maintenance of the collection of cultures obtained from all over the rice growing tract of the world, continuation of the trials of Chinese types with the short duration strains of Coimbatore, economic work by hybridization, cultural, manurial and irrigation experiments; introduction of varieties suited to ordinary wet conditions, rainfed conditions and submerged areas, evolution of high yielding, and diseases, alkalinity and drought resisting varieties and quality work on rice.

(3) *Cotton and other fibres—Irrigated cottons.*—Conduct of yield trials in Salem, Trichinopoly, South Arcot, Coimbatore and Ramnad districts; multiplication of strains X 3915 and X 4383 and spreading them in Salem, North Arcot, Ramnad, Bellary and Kurnool districts, testing the purity of cultures found promising in the progeny rows, comparing the performance of selections made in F_2 and in later generations, making selections in the crosses newly made, studying the performance of progenies of the crosses made between the new tetraploid and other tetraploid cottons and continuing the attempts on the production of polyploids by colchicine, and studies of inheritance of lintlessness in American cottons.

Rainfed cottons.—Conduct of yield trials in Coimbatore and Trichinopoly districts, comparison of yields of K.1. obtained from various centres, isolation of types resistant to drought, conduct of progeny row trials, and continuation of the study of inheritance of lintlessness, floral anatomy, filament colour, lint colour and development of fuzz.

Study of the relative effects of several preparatory cultivation methods on the cost of production of cotton and study of the effects of different rotations on the yield of cotton.

Indian Central Cotton Committee Schemes.—Work on the schemes financed by the Indian Central Cotton Committee will be continued as per programme approved by the Committee.

Trials of sunnhemp and gogu varieties will also be continued.

(4) *Sugarcane.*—Varietal, cultural, botanical and chemical studies, study of the fibre content of promising varieties, available commercial cane sugar from promising varieties, deterioration of cane after harvest, and keeping quality of jaggery. Programme of work approved by the Imperial Council of Agricultural Research for the scheme of research on sugarcane at Gudiyattam and Anakapalle will be carried out.

(5) *Fruits.*—Root-stock trials of apples, plums and chermoyer, cross pollination of plums which are shy or practically non-bearers, study of new varieties of peaches, plums, pear, apricot and walnut from the North-West Frontier Province and cherry and strawberry from England. Study of the floral characters of mango varieties, description of the representatives of all kinds of citrus, work on fruit-canning, fruit beverages and candying and propagation and sale of nursery plants. Programme of work approved by the Imperial Council of Agricultural Research for the Fruit Research Scheme will be carried out.

(6) *Root-crops.*—Multiplication of potato crosses on a small scale, experiments on comparative trials, posture of seed, cut experiment and time of cutting and study of dormancy of tubers.

(7) *Oil-seeds—Groundnuts.*—Wilt control experiment, groundnut "surul attack," pure cropping of groundnut versus mixed cropping, seed multiplication and district trials.

Castor.—Comparative yield tests, hybridization studies, district trials, qualitative studies, maintenance of inbred types, seed multiplication of promising strains, developmental and root studies.

Gingelly.—Trial of promising strains to judge their suitability for cold weather cropping, study of the progenies of "interseasonal varietal crosses," comparative yield trials of promising selections, isolation of widely differing types and their description, seed multiplication of different varieties and single plant selection, study of progenies of crosses.

Coconuts.—Manurial experiments, cultural and electrocultural experiments, experiments to increase the humus content of the soil, study of the root system of seedlings, study of the world varieties, investigation into the causes of button shedding, studies of the progenies of crosses, trial of subsidiary crops for coconut plantations.

The programme of work approved by the Imperial Council of Agricultural Research in respect of coconut and groundnut schemes will be carried out.

(8) *Spices and narcotics.*—Comparison of the degree of germination of clove seeds, determination of the period of viability of clove seeds, investigation of the possibilities of vegetative propagation of cloves, comparative trials of chillies, study of cultures of tobacco.

(9) *Pulses.*—Trial and selection of lablab types of good quality and yield, studies in the inheritance characters of cowpea, selection of economic strains of cowpea suitable for (i) grain, (ii) green manuring and fodder and (iii) vegetable; multiplication of seed of Bengalgram strains Nos. 482 and 468, comparison of yields of promising redgram types in progeny rows and in plots and isolation of types resistant to wilt and earlier in duration.

D. Entomology.—Study of the following pests: Sugarcane moth borers, coconut beetle, paddy stem borer, fruit flies, tobacco caterpillar, groundnut surul, chilly and cardamom thrips, cotton bollworms, cotton stem weevil, fruit sucking moth, pollu disease of pepper, pests on stored products, Antigastra on chilly, the jasmine mite, and woolly Aphis on apples. Trial of patent and indigenous studies, studies on economic families, research on bee-keeping on the following items—Study of swarm prevention methods, pollen substitutes, bee pasturage plants, improvement of plains variety of the Indian bee by crossing it with the Hill variety, and trials of extraction of the Rock bee honey.

E. Mycology.—Study of piricularia and *Helminthosporium* of paddy and ragi, smut and yellow diseases of cholam, red-rot and mosaic disease of sugarcane, seedling blight and boll rot of cotton, wilt on groundnut, nursery and virus diseases of tobacco, mahali and Gloesporium blight disease of Areca palm, leaf fall and fruit rot and gummosis and bark rot of citrus, little leaf of brinjal, mosaic disease of cardamom and soft rot of ginger.

F. Implements.—The following problems will be tackled :—

Improvement on mechanical seed drill, evolution of a suitable and efficient groundnut harvesting machine, making of a cheap and small portable winnowing machine, alteration in the handpower cotton gin for increased output and easier turning moment, evolution of a small size disc plough, modifications, in the spring tyned expanding cultivator to help penetration and make the haulage comparatively easy, making of a simple butter churn, tests on improved boiling pans and furnaces, arecanut dehusking machine, groundnut decorticators, handpower rice shellers, bullock power sugarcane crushers, ginger polishing machine and portable threshing machines, and evolution of the following machines, grain polishing and dehusking machines, fruit grading machine for oranges, broadcast seed sower appliances, plant transplanters, earth graders for black soils, ragi hoe for bullock power, manure distributors for hand operation and portable water lifts for canal irrigation.

G. Irrigation.—Study of the requirements of water for paddy will be continued.

H. Marketing.—The marketing surveys of sugar, jute, fish, maize, mustard, grams and cashewnut will be continued. With the publication of the All-India Survey reports, the provincial reports will be revised and brought up to date for publication. Possibilities of extending the Commercial Crops Markets Act and the inclusion of other agricultural commodities will be examined. Formation of co-operative marketing associations and opening of more grading stations will be taken up. Popularization of standard

packages for eggs, and supply of market intelligence to producers, co-operative associations and traders, examination and drawing up standard contract forms for groundnut, tobacco, etc.

Agricultural Research Stations.

Anakapalle—Sugarcane.—Varietal, cultural, botanical, chemical and industrial studies. Determination of the optimum size and shape of plots for experimental work.

Paddy.—Multiplication of improved strains under distribution, study of the performance of progenies or single ear selections, comparative trials of promising pure lines against local standards, trial of dry land paddy varieties, manurial experiments.

Millets.—Multiplication of improved strains, comparison of promising strains, study of economic characters, mass selection and evolving economic bulks, collection of seed material from the district.

Other crops.—Observation of cigar, cigarette and beedi types of tobacco, propagation of fruits by budding, side-grafting, raising various varieties of fruits and multiplication of promising varieties of plantains and study of their performance, comparative trials in groundnut and multiplication of varieties for distribution in the district.

General.—Poultry-rearing, Apiculture, raising short crop of sugarcane for planting material.

Maruteru—Paddy.—Improvement of local varieties of paddy, introduction of varieties suited to ordinary wet conditions, rainfed conditions and submerged areas, hybridization studies, inducing mutation by continuous stubble propagation, spacing, irrigation and manurial experiments.

Other crops.—Five year rotation with sugarcane, paddy and plantain, long term of garden plantain.

General.—Electro-culture experiments.

Samalkota—Paddy.—Selection of pure lines, yield trials of the isolated pure lines, trial of varieties in the intermediate season, study of the manurial experiments and multiplication of the improved strains under distribution.

Sugarcane.—Yield trials of the promising varieties, cultural studies like spacing, etc., study of the effect on the quality and quantity of jaggery under lodging conditions, application of graded doses of N in combination with different doses of P 205, and application of compound fertilizers.

Plantain.—Study of the performance of different varieties under winter and hot weather plantings, study of the manurial requirements under the two systems of planting, trial of compound fertilizers on plantain, preparation of plantain figs.

Other crops.—Trial of sunnhemp and gogu varieties for fibre, study of the performance of Coimbatore redgram varieties, trial of lablab, wheat, vegetables and pine-apple varieties.

Side lines.—Poultry and apiculture.

Guntur.—Selections, purity tests, comparative yield trials of cotton, chillies, tobacco, gogu, cholam, sajja, variga, korra, maize and groundnut.

Other crops.—Trial of Pusa wheat, castor strains, Indian vegetables, observation manure and character study of fruit plants, silage making, trial of omum, tapioca and others as specimen crops.

Buchireddipalayam.—Selection in local varieties of paddy, study of hybrid cultures of G.E.B. 24, Kusuma and Krishna katukalu, isolation of blast resistant culture in Molakolakulu, introduction of new varieties of paddy in place of Iswarakora, experiments to find out the optimum age of paddy seedlings and the maximum age of paddy seedlings in a dry nursery.

Fruit Research Station, Kodur.—Study of the floral characters of mango varieties, description of the representatives of all kinds of citrus, work on fruit-canning, fruit beverage and candying propagation and sale of plants.

Dry Farming Station, Hagari.—Cyclic crossing of H. 1 with other reputed cotton types and selection of fruitful combinations, comparison of E.C. 593 and R. 42 ragi against the local types in the ragi tracts, improvement of safflower, bengalgram and onions and planting trials of sugarcane. The programme of work for the dry farming scheme as approved by the Imperial Council of Agricultural Research will be carried out.

Nandyal.—Selection work on cotton and jonna, trials of groundnut, bengalgram and redgram strains, study of residual effect of crack filling experiments with groundnut husk experiment on the comparative value of compost and farm yard manure, experiments on green manuring in dry lands, rotation and cultural experiments, trial of vegetables, lucerne and berseem, cambodia cotton, chillies, onions, sweet potatoes, ragi and irrigated tobacco under garden land conditions.

Side lines.—Compost making, silage making, poultry-rearing, goat-rearing and bee-keeping. Education of non-stipendiary course students, training of Foresters, Chenchus and maistries and messengers.

Palur—Sugarcane.—Eleven new varieties will be tried. Comparative trials with short duration varieties and manurial trials. Study of chewing varieties, cost of production.

Paddy.—Seed distribution and multiplication of important strains, comparative trials of piricularia resistant strains and manurial trials.

Other crops.—Single plant selections of kulla ragi, perum ragi and varagu, varietal trials of groundnut, trial of Co. 920, 4383 and 3915 cotton varieties and fodder crops.

Miscellaneous.—Vegetable gardening, poultry-rearing and apiary.

Aduturai—Paddy.—Multiplication of seed for distribution, district trials of Aruvatham kuruvai, Thattan samba and Pedda samba, study of isolated units of single plants, yield tests of pure line units, and progenies of crosses, hybridization studies, manurial trials, electro cultural experiments, and irrigation experiments.

Other crops.—Cultivation of sugarcane, plantain, vegetable fodder crops and fruits.

Miscellaneous—Poultry-farming, apiculture, and pisciculture.

Pattukkottai—Paddy.—Reduction of seed rate, economic planting of paddy and growing of strains, multiplication of Aduturai and Coimbatore strains.

Other crops.—Growing of sugarcane, plantain, turmeric, groundnut and chillies.

Kovilpatti—Cotton.—Studies in crosses and back crosses of K. 1 cotton, trial of Cambodia strains 3915 and 4383 in Masipattam season.

Millets.—Comparative trials of the successful strains from row trials, growing of strains for seed multiplication, selection work in white ragi, comparative trials of ragi strains E.C. 2928, 2985, 24 and local and trial of E.C. 3517 with mutt ragi.

Miscellaneous crops.—Trial of coriander, black and green gram, castor strains and A.H. 45 groundnuts.

Side lines.—Permanent rotation and cultural experiments, ridging and ploughing experiments after cholam, spacing experiment of cotton, study of the effect of varying doses of cattle manure applied to cereals on the succeeding cotton, inter-cultivation experiments on cumbu and studying the effects of sparked water on vegetables and on cotton and cholam seeds, poultry-farming and maintenance of the Scindhi breeding stock.

Ambasamudram.—Comparative trials and inter-varietal trials of paddy (Kar, second crop and Pishanam), trials with daincha, sunnhemp, kolingi, pillipesara, sesbanica speciosa.

Nanjanad—Potato.—Comparative trials, experiments with posture of seed, cut experiment, and time of cutting, study of dormancy of tubers and multiplication of Great Scot for seed distribution.

Other crops.—Trial of lupins, pyrethrum, castor, Virginian tobacco, garlic, chillies, berseem, Australian wheats, Aberstwyth winter oats, Pusa types of wheat, oats and barley, dwarf beans, niger, buck wheat, and sweet potato.

Pattambi—Paddy.—Maintenance of purity and multiplication of strains so far released, comparative trials of promising cultures, trial of exotic types with local strains, hybridization studies, cultural experiments, manurial trials, investigation of the causes of bad germination of Coimbatore strains in South Kanara and monthly sowings of Pattambi strains for studying their period—bound or season bound nature.

Other crops.—Spacing, manuring experiments of pine apple, growing of cotton as a mixture crop with the modan paddy, and growing of samai, ragi and groundnut and castor in modan lands as regular rotational crops.

Taliparamba.—Expansion of nursery work, soft rot experiments on ginger, growing of paddy strains evolved at Pattambi suitable for North Malabar, growing of suitable Coimbatore canes, experiments on pepper.

DEMONSTRATION.

Crops.—Extension of areas under the improved varieties and strains of paddy, sugarcane, millets, cotton, oil-seeds, extension of fruits cultivation, thin sowing of nurseries, economic planting, inter-culturing with bullock power, thick sowing of groundnut in poorer soils, line sowing of cotton, trenching of sugarcane, and reduction of seed-rate of various crops.

2. *Implements.*—Introduction of improved ploughs, guntakas, roll-easy mhote wheels, improved water lifts, ridge ploughs, chaff-cutters, buck-scrapers, sprayers, turmeric polishers and cane mills and inducing the ryots to purchase these on the Takkavi loan system.

3. *Manures.*—Conservation of cattle manure on improved lines, preventing wastage of urine by the Byre system, composting of organic waste by various methods, extension of green manuring and green leaf application and uses of concentrated manures such as cakes.

4. *Jaggery manufacture.*—Improvement in furnace construction and jaggery making.

5. *Pests and diseases.*—Control of pests and diseases and demonstration of remedial measures.

6. Exhibitions, formation of village associations, distribution of Villagers' Calendar and leaflets, sale of bulletins, introduction of cottage industries such as poultry-rearing and bee-keeping.

7. *Seed supply.*—In addition to the seed grown in Government research stations, seed farms for the multiplication and distribution of improved strains of crops such as paddy, cotton, sugarcane, groundnut, potato will be conducted as stated below :—

Cotton.—Seed farms shown below will be continued :—

H. 1 Cotton ..	Guntakal for Westerns tract (3,000 acres).
N. 14 Cotton ..	Nandyal for Northerns tract (1,400 acres).
Co. 2 Cotton ..	Tirupur (1,000 acres by Government and 5,000 acres by Tirupur Co-operative Sale Society).
	Salem, Rasipuram and Tiruchengode taluks (Salem district) (500 acres).
Co. 3 and Co. 4. (These are the new designations of X 3915 and X 4383 respectively.)	Masipattam season in Sattur and Srivilliputtur taluks in Ramnad district and Sankarankoil taluk of Tinnevelly district (800 acres).
K. 1.	Udamalpet taluk, Coimbatore district (800 acres).
	Tinnevelly district (900 acres).

Special schemes sanctioned by Government for the multiplication of the seed material of the following crops through the co-operative societies in the taluks mentioned against each will be initiated or continued :—

Paddy	Attur (Salem district), Vellore (North Arcot district), Walluvanad (Malabar district) and Mangalore (South Kanara district).
Groundnut ..	Pollachi (Coimbatore district).
Potato	Ootacamund taluk (Nilgiris district).

I have the honour to be

Sir,

Your most obedient servant,

A. R. C. WESTLAKE,

Director of Agriculture.

[Appendices

APPENDIX I.

LEAVE, TRANSFER, APPOINTMENT, CONFIRMATION, ETC.

Indian Agricultural Service.—Mr. Saadat-ul-lah Khan on return from long leave on 18th November 1939 resumed charge of the duties of the Deputy Director of Agriculture, III Circle, Trichinopoly.

Madras Agricultural Service.—Sri K. T. Alwa on return from leave on 6th August 1939 resumed charge as Headquarters Deputy Director of Agriculture and Sri K. Unnikrishna Menon on relief proceeded on leave for three months.

Sri M. Kanti Raj Nayudu, Gazetted Assistant to the Principal, was in additional charge of the post of Junior Lecturer in Agriculture till 12th September 1939 when he was relieved of the Gazetted Assistant's post by Sri E. Kunhappa Nambiyar. Sri M. Kanti Raj Nayudu continued as Junior Lecturer in Agriculture till 5th December 1939 when he was transferred as Assistant Director of Agriculture, St. Thomas Mount and Sri C. Ramaswami Nayudu took his place. The latter was again transferred to Cuddapah on 12th April 1940 as Deputy Director and Sri Kanti Raj Nayudu was again transferred to Coimbatore in his place. The temporary post of Gazetted Assistant to the Principal having been abolished from 22nd November 1939 Sri E. Kunhappa Nambiyar, was reverted to Subordinate Service.

Mr. K. M. Thomas, Government Mycologist, proceeded on three months' leave from 11th March 1940. Sri D. Marudaraja Pillai, seniormost assistant in the section was appointed to officiate as Government Mycologist.

Sri P. S. Jivanna Rao, Lecturer in Botany, having been granted 28 months' leave from 26th January 1940, Sri S. N. Chandrasekhara Ayyar, Assistant in Botany and Probationer in the Madras Agricultural Service, was appointed in his place.

Sri V. K. Subrahmanya Mudaliyar, Gazetted Assistant, Mungari Scheme, Adoni, proceeded on leave for four months from 7th July 1939 and Sri R. Balasubrahmanya Ayyar was appointed in his place.

In the I Circle Sri B. Ramayya, Deputy Director of Agriculture, I Circle, Cocanada, proceeded on leave from 1st July 1939 and Sri Y. G. Krishna Rao Nayudu, Officiating Deputy Director of Agriculture, III Circle, was posted in his place. The former continued to be on leave throughout the year under report.

Sri A. Gopalakrishnayya Nayudu continued as Assistant Director of Agriculture, Guntur, till 27th November 1939 when he was transferred to Nellore and he was succeeded by Sri R. Swami Rao.

The Gazetted post of Superintendent, Agricultural Research Station, Maruteru, having been abolished, Sri K. Venkataraman, who held that post was transferred to Agricultural Research Station, Anakapalli as Superintendent on 12th September 1939 and Sri A. Ramaswami Ayyar on relief proceeded on leave.

In the II Circle Sri T. Budhavidheya Rao Nayudu, Deputy Director of Agriculture, Cuddapah, proceeded on leave in July 1939 and rejoined duty on the 1st August and continued there till 28th January 1940 when he again proceeded on leave and after its expiry was transferred to the Veterinary Department as Superintendent, Livestock Research Station, Hosur. During his absence, Sri R. N. K. Sundaram, Assistant Director of Agriculture, Bellary, held additional charge of the post till 4th April 1940 when Sri C. Ramaswami Nayudu, Junior Lecturer in Agriculture replaced him. Sri V. N. Subbanna Acharya continued to officiate as Assistant Director of Agriculture, Bellary, till 27th November 1939 when he was relieved by Sri R. N. K. Sundaram.

Sri K. Raghava Acharya, Assistant Director of Agriculture, Cuddapah, proceeded on leave from 6th April 1940. Sri V. N. Subbanna Acharya, probationer in the Madras Agricultural Service was posted in his place and he remained in charge till the end of the year under report.

Sri R. N. K. Sundaram remained as Assistant Director of Agriculture, Nellore, till 5th August 1939 when he was transferred to III Circle as Deputy Director of Agriculture and Sri L. Narasimha Acharya who was appointed in his place continued till 3rd December 1939 when he was relieved by Sri A. Gopalakrishnayya Nayudu.

Sri A. Gopalan Nayar continued to officiate as Assistant Director of Agriculture, St. Thomas Mount, till 26th August 1939 when he went on leave. Sri R. Swami Rao, Assistant Director of Agriculture, was posted in his place. The latter remained there till 18th November 1939 when he was transferred to Guntur as Assistant Director of Agriculture and Sri A. Ramaswami Ayyar on return from leave was posted to St. Thomas Mount. This officer was subsequently transferred as Assistant Director of Agriculture, Tiruppattur, his place being taken by Sri Kanti Raj Nayudu, Junior Lecturer in Agriculture, Coimbatore, on 12th December 1939. The latter was re-transferred to Coimbatore as Junior Lecturer in Agriculture and Sri E. Kunhappa Nambiyar was posted to St. Thomas Mount on 19th April 1940.

In the III Circle, Sri Y. G. Krishna Rao Nayudu remained as Deputy Director till 14th August 1939 when he was transferred to I Circle. He was succeeded by Sri R. N. K. Sundaram who continued as Deputy Director of Agriculture till 18th November 1939 when Mr. Saadat-ul-lah Khan rejoined duty after return from leave.

The Gazetted post of Superintendent, Agricultural Research Station, Pattambi, having been abolished, Mr. Samuel Jobitha Raj who held that post was transferred as Assistant Director of Agriculture, Madura, where he joined on 5th September 1939. Sri E. Kunhappa Nambiyar, Assistant Director of Agriculture, Madura, was transferred to Coimbatore as temporary gazetted assistant to the Principal.

Sri R. Swami Rao continued as Assistant Director of Agriculture, Cuddalore, till 8th September 1939 when he was transferred to St. Thomas Mount. He was succeeded by Sri M. Anandan, the post of Superintendent, Agricultural Research Station, Aduturai, held by him having been abolished.

Sri S. Narayana Ayya, Temporary Assistant Director of Agriculture, Pattukkottai, was placed under suspension from 18th November 1940 pending enquiry. Sri A. Gopalan Nayar, probationer in the Madras Agricultural Service was posted in his place and he joined duty there on 12th March 1940.

Sri R. Chockalingam Pillai, Assistant Director of Agriculture, Tinnevelly, having gone on leave for six months from 27th March 1940, Sri V. T. Subbayya Mudaliyar, probationer in the Madras Agricultural Service was appointed in his place.

In the IV Circle, Sri C. Ramaswami Nayudu continued as Deputy Director of Agriculture till 12th November 1939 when he proceeded on short leave. Sri K. Unnikrishna Menon on return from leave was posted to IV Circle as Deputy Director.

Sri V. T. Subbayya Mudaliyar, Officiating Assistant Director of Agriculture, Tiruppattur, continued there till 20th December 1939 when Sri A. Ramaswami Ayyar relieved him. The officiating appointment in the Madras Agricultural Service held by Sri V. T. Subbayya Mudaliyar ceased from that date.

Sri P. Abhishekanatham Pillai, Officiating Curator in the Madras Agricultural Service was confirmed in his appointment during the year.

The post of Provincial Marketing Officer which continued on a temporary basis since 1935 was made permanent with effect from 1st August 1939. Sri Rao Bahadur K. Gopalakrishna Raju, Officiating Provincial Marketing Officer proceeded on leave from 21st June 1939 to 17th August 1939 and during this period Sri K. W. Chakrapani Marar, Assistant Marketing Officer was in additional charge.

The temporary posts of Assistant Director of Agriculture, Pattukkottai, Assistant Marketing Officers, Soil Physicist and the Superintendent, Dry Farming Station, were continued during the year.

For improving Cocanada cotton, a temporary post of Gazetted Assistant financed by the Indian Central Cotton Committee was sanctioned for a term of five years and Sri R. Balasubrahmanya Ayyar was appointed to the post with effect from 1st February 1940.

Another temporary post of Parasitologist for investigating the possibilities of control of the cotton stem weevil in South India financed by the Indian Central Cotton Committee was also sanctioned and Sri P. N. Krishna Ayyar, Officiating Assistant Entomologist was appointed to the post from 30th October 1939.

Madras Agricultural Subordinate Service.—The cadre of Upper and Lower Subordinate Services was increased by 8 posts; 3 posts in the Science Section and 5 posts in the Agricultural Section. The former was sanctioned to replace the gazetted posts abolished and the latter to provide men for work in the Livestock Section.

APPENDIX II.

THE WORKING OF THE AGRICULTURAL COLLEGE DAIRY.

The dairy herd consisted of 27·7 cows, as against 26·4 in the previous year. About 20 cows were in milk. The average daily yield per cow in milk was 15·2 lb. and the average over all in the herd was 10·9 lb. as against 16·3 lb. and 11·5 lb. respectively of the previous year.

The total milk yield for the year was 111,449¾ lb. the quantity handled for the last year (15 months) being 138,509 lb. The milk was disposed of as follows :—

Particulars.	1939–40.	1938–39.
	LB.	LB.
Sold	85,865½	90,765
Fed to calves	7,183¼	14,391
Separated	17,002	32,457
Colastrum, Exhibition, etc. ..	1,300	1,820
Deficit	99	66

The outturn and disposal of cream and butter were as follows :—

Particulars.	1939–40.	1938–39.
	LB.	LB.
Milk separated	17,002	32,457
Cream obtained	1,735	3,260
Cream converted into butter ..	1,729	3,212
Butter obtained	985	1,774
Butter sold	980	1,367½
Butter converted into ghee ..	3½	315
Miscellaneous (for milking, etc.) ..	25	56¾

The receipts by the sale of eggs and poultry amounted to Rs. 419–4–0 only as against Rs. 937–6–4 of the previous year.

The financial result of the working of the Agricultural College Dairy for the year shows a net loss of Rs. 447–4–11 as against a net loss of Rs. 2,099–12–6 in the previous year.

GLOSSARY

Apple	*Pyrus malus.*
Arecanut	*Areca catichu.*
Barley	*Hordeum vulgaro.*
Bengalgram	*Cicer arietinum.*
Ber	*Zizyphus jujuba.*
Betal vine	*Piper betel.*
Blackgram	*Phaseolus mungo var. Radiatus, hook.*
Brinjal	*Solanum melongena.*
Buchu	*Barosma betulina.*
Cardamom	*Elettaria cardamomum.*
Carrots	*Daucus carota.*
Cashewnut	*Anacardium occidentale.*
Castor	*Ricinus communis.*
Chillies	*Capsicum sp.*
Cholam	*Sorghum vulgare.*
Clove	*Eugenia caryophyllata, Thunb.*
Coconut	*Cocos nucifera.*
Coffee	*Coffea arabica.*
Cotton	*Gossypium.*
(i) Cambodia cotton	*Gossypium hirsutum.*
(ii) Karunganni cotton	*Gossypium indicum.*
(iii) Uppam cotton	*Gossypium herbaceum.*
(iv) Pulichai cotton	*Gossypium neglectum.*
(v) Westerns cotton	*Mixture of Gossypium herbaceum and indicum.*
(vi) Northerns cotton	*Mixture of Gossypium herbaceum and indicum.*
(vii) Roseum cotton	*Gossypium var. Rosea, watt.*
(viii) Nadam cotton	*Gossypium var. Nadam, watt.*
Coriander	*Coriandrum sativum.*
Cowpea	*Vigna catiang.*
Cumbu	*Pennisetum typhoideum.*
Dhaincha	*Sesbania aculeata.*
Durian	*Durio zibethinus, Dc.*
Elephant grass	*Pennisetum purpurea.*
Field beans	*Dolichos lablab.*
Figs	*Ficus carica.*
Garlic	*Allium sativum.*
Gingelly	*Sesamum indicum.*
Ginger	*Zingiber officinale.*
Gogu	*Hibiscus cannabinus.*
Grape-vine	*Citrus decumana.*
Greengram	*Phaseolus mungo.*
Groundnut	*Arachis hypogœa.*
Guava	*Psidium guyava, Llnn.*
Guinea grass	*Panicum maximum.*

Horsegram	*Dolichos biflorus.*
Indigo	*Indigofera sumatrana.*
Jack	*Artocarpus integrifolia, Linn.*
Jalap	*Ipomea purga.*
Kikyu grass	*Pennisetum clandestinum.*
Kolingi	*Tephrosia purpurrea.*
Kollaganjeru	*Ipomea hispida.*
Kolukattai grass	*Pennisetum cenchroides.*
Korra	*Setaria italica.*
Lime	*Citrus acida.*
Linseed	*Linum usitatissimum.*
Loquats	*Eriobotrya Japonica.*
Lucerne	*Medicago sativa.*
Maize	*Zea mays.*
Mangoes	*Mangifera indica, Linn.*
Mangosteen	*Garcinia mangostana.*
Mustard	*Brassica juncea.*
Neem	*Azadirachta indica.*
Oats	*Avena sativa.*
Onions	*Allium sativum.*
Oranges	*Citrus aurantium.*
Paddy	*Oryza sativa.*
Panivaragu	*Panicum miliaceum.*
Palmyra	*Borassus flabellifer.*
Papaya	*Carica papaya.*
Peach	*Persica vulgaris.*
Pears	*Pyrus communis.*
Pepper	*Piper nigrum.*
Pillipesara	*Phaseolus trilobus, Ait.*
Pineapple	*Ananas sativa.*
Plantain	*Musa sapientum.*
Plums	*Prunus salicina.*
Pomegranate	*Punica granatum, Linn.*
Potato	*Solanum tuberosum.*
Pungam	*Pongamia glabra.*
Radish	*Raphanus sativas, Linn.*
Ragi	*Eleusine coracana.*
Redgram	*Cajanus indicus.*
Royal palm	*Oreodora regia.*
Safflower	*Carthamus tinctorius.*
Samai	*Panicum miliare.*
Sapota	*Achras sapota.*
Soya beans	*Glycine soja.*
Strawberries	*Fragaria vesca.*
Sugarcane	*Saccharum officinarum.*
Sunnhemp	*Crotolaria juncea.*
Tamarind	*Tamarindus indica, Linn.*
Tapioca	*Manihout utilissima.*
Tenai	*Setaria italica.*
Teosinte	*Euchloena, mexioena—Schrad.*

Tobacco	*Nicotiana tabacum.*
Tomato	*Cyphomandra betacea.*
Travellers' tree	*Ravenala madagascariensis.*
Tung oil plant	*Aleurities fordii.*
Turmeric	*Curcuma longa.*
Variga	*Panicum miliaceum.*
Varagu	*Paspalum scrobiculatum.*
Water hyacinth	*Eichhornia crassipes, Solms.*
Wheat	*Triticum spp.*
Wild indigo	*Tephrosia purpurea.*

Government of Madras

DEVELOPMENT DEPARTMENT

G.O. No. 923, 17th May 1941

Administration Report—Agriculture—1939–40—Recorded.

READ—the following paper :—

From the Director of Agriculture, dated 31st October 1940, D-3, No. 68-Pdl. 40.

Order—No. 923, Development, dated 17th May 1941.

Recorded.

His Excellency notes with pleasure the research work continued by the Department in various directions, but efforts must be made to keep the demonstration and propaganda work more in pace with research. The departmental publications and bulletins for propaganda numbered only 16 and talks on the radio only 7. The Government have since ordered a more frequent and systematic use of the wireless. Now with a separate agricultural officer in charge of each district for closer supervision over demonstration and a Deputy Director exclusively for directing propaganda, His Excellency trusts that the results of the various researches will be put across to the ryot in a more effective manner and that the help of the department to the ryot will take a far more practical shape than appears to have been the case in the past.

The experiments in the malting of cholam which have resulted in its being taken up as a cottage industry in the Chittoor district, and in fruit canning at Kodur which have resulted in the encouragement of private nurseries, are noted with interest. It is hoped that the department will strive for a further expansion of these practical results.

Large numbers of fruit plants have been distributed from agricultural farms, but no record has been kept of the subsequent history of the plants. The Government have since ordered the maintenance of such a record with a view to seeing how far the distribution has had practical results and to indicating lines for further research.

It is also interesting to note that the efforts of the department have resulted in an increase in the areas sown with improved strains of seeds and also in the use of green manure by ryots.

The report shows that the experiments in electro-cultural treatments continued during the year have shown no perceptible effect. The Government have since ordered the discontinuance of these experiments.

(By order of His Excellency the Governor)

C. P. KARUNAKARA MENON,
Secretary to Government.

To the Director of Agriculture.
,, Director of Veterinary Services.
,, Registrar of Co-operative Societies.
,, Education and Public Health Department.
,, Public Works Department.
,, Accountant-General, Madras.
,, Government of India, Department of Education, Health and Lands (with C.L.).
,, Public Department.

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